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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT. ACCESSION NO. AD-A092038
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) Phase I Inspection Report Mt. Beacon Reservior Hudson River Basin, Dutchess County, New York Inventory No. 026	5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Eugene O'Brien	8. CONTRACT OR GRANT NUMBER(s) DACW-51-79-C-0001
9. PERFORMING ORGANIZATION NAME AND ADDRESS Tippetts-Abbett-McCarthy-Stralton 655 Third Avenue New York, New York 10017	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS New York State Department of Environmental Conservation 50 Wolf Road Albany, NY 12233	12. REPORT DATE 30 September 1980
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Department of the Army 26 Federal Plaza New York District, CofE New York, NY 10287	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

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18. SUPPLEMENTARY NOTES

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Mt. Beacon Reservoir Dam
Dutchess County
Dry Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and the visual inspection of Mt. Beacon Reservoir Dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 16 percent of the PMF. The overtopping of the dam could cause dam failure, thus significantly increasing the hazard to the loss of life downstream. The spillway is therefore adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.

Structural stability analysis based on available information and the visual inspection indicates that the stability of the non-overflow section against overturning and sliding is inadequate for all loading conditions.

It is therefore recommended that within 3 months of notification to the owner, detailed hydrologic/hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the one-half PMF. Within twelve months of the date of notification to the owner, modifications to the structure, deemed necessary as a result of the studies, should have been completed. At the same time, a detailed investigation of the structural stability of the non-overflow section should be performed. In the interim, a detailed emergency action plan must be developed. Also, around-the-clock surveillance of the structure must be provided during these periods.

In addition, the dam has a number of problem areas which, if left uncorrected, have the potential for the development of hazardous conditions and must be corrected within twelve (12) months.

1. Establish a systematic program to observe and monitor changes in seepage occurring at the outlets of the seepage drains located on the downstream face of the gravity sections.

2. Backfill low area at the left abutment with concrete to the level of the crest of the dam.

3. Determine the sources of seepage occurring at the spillway right abutment contact, and in the vicinity of downstream from the toe of the dam near the left abutment. Monitor the seepage biweekly with the aid of weirs.

4. Remove the vegetation in the spillway channel and the area downstream from the toe of the dam. Provide a program of periodic cutting and mowing of these areas.

5. Repair the side walls of the spillway and the reservoir drain channels.

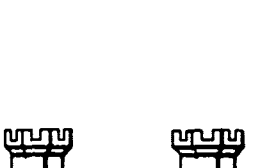
6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

HUDSON RIVER BASIN

MT. BEACON RESERVOIR

DUTCHESS COUNTY, NEW YORK
INVENTORY NO. N.Y. 26

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1980

CONTRACT NO. DACW-51-79-C0001

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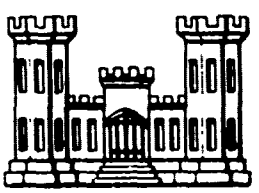

NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1980

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C., 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
MOUNT BEACON RESERVOIR DAM
I.D. NO. N.Y. 26
D.E.C. NO. 537
HUDSON RIVER BASIN
DUTCHESS COUNTY, NEW YORK

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I.D. NO. N.Y. 26
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HUDSON RIVER BASIN
DUTCHESS COUNTY, NEW YORK

Name of Dam:	Mt. Beacon Reservoir Dam (I.D. No. N.Y. 26)
State Located:	New York
County Located:	Dutchess
Stream:	Dry Brook
Basin:	Hudson River
Date of Inspection:	July 24, 1980

ASSESSMENT

The examination of documents and the visual inspection of Mt. Beacon Reservoir Dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 16 percent of the PMF. The overtopping of the dam could cause dam failure, thus significantly increasing the hazard to the loss of life downstream. The spillway is therefore adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in

spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.

Structural stability analysis based on available information and the visual inspection indicates that the stability of the non-overflow section against overturning and sliding is inadequate for all loading conditions.

It is therefore recommended that within 3 months of notification to the owner, detailed hydrologic/hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the one-half PMF. Within twelve months of the date of notification to the owner, modifications to the structure, deemed necessary as a result of the studies, should have been completed. At the same time, a detailed investigation of the structural stability of the non-overflow section should be performed. In the interim, a detailed emergency action plan must be developed. Also, around-the-clock surveillance of the structure must be provided during these periods.

In addition, the dam has a number of problem areas which, if left uncorrected, have the potential for the development of hazardous conditions and must be corrected within twelve (12) months.

1. Establish a systematic program to observe and monitor changes in seepage occurring at the outlets of the seepage drains located on the downstream face of the gravity sections.

2. Backfill low area at the left abutment with concrete to the level of the crest of the dam.

3. Determine the sources of seepage occurring at the spillway right abutment contact, and in the vicinity of downstream from the toe of the dam near the left abutment. Monitor the seepage biweekly with the aid of weirs.

4. Remove the vegetation in the spillway channel and the area downstream from the toe of the dam. Provide a program of periodic cutting and mowing of these areas.

5. Repair the side walls of the spillway and the reservoir drain channels.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

Eugene O'Brien

Eugene O'Brien, P.E.
New York No. 29823

Approved by:

Col.W.M. Smith, Jr.
New York District Engineer

Date: 30 Sep 80

1. OVERVIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROJECT
MOUNT BEACON RESERVOIR DAM
I.D. NO. N.Y. 26
D.E.C. NO. 537
HUDSON RIVER BASIN
DUTCHESS COUNTY, NEW YORK

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the State of New York, Department of Environmental Conservation by a letter dated 7 January 1980, in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367, 8 August 1972.

b. Purpose of Inspection

This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF THE PROJECT

a. Description of the Dam and Appurtenant Structures

The Mount (Mt.) Beacon Reservoir Dam consists of about a 350 foot long, 35 foot high gunite surfaced concrete masonry gravity, and concrete buttress dam with a spillway at the right side of the dam. According to available drawings dated July 1922 (See Appendix A), the gravity section under the gunite surface is masonry with concrete at the downstream face of the masonry; the upstream and downstream faces of the section are 7V:1H and 0.37V:1H, respectively; and the crest is about 8.5 feet wide. The dam is made up of 10 buttresses forming eleven (11) bays. The width of each buttress is about 2.5 feet. The length of bays varies between 21 to 22 feet, except for the two end bays. The bay at the left abutment is about 32 feet wide and at the right abutment, about 73 feet, of which 43 feet serves as the spillway. The spillway is broad crested, ungated and has a sill about 8 feet wide and the crest is 1.5 feet from the top of the dam. The downstream face of the spillway is "ogee shaped" and is flanked on the left and the right by a buttress and a wing wall, respectively. The discharge over the spillway flows into a natural channel with sides protected by 2 foot wide concrete walls except at the right side a portion of which is rock.

The 22-inch diameter cast iron reservoir drain is located about 150 feet from the right abutment. Flows from the drain are controlled by two manually operated gate valves located upstream and downstream of the dam. The upstream gate valve is operated from a control located at the top of the dam, with access from a steel decked platform. The downstream gate valve is operated from a control located in a gate house at the toe of the dam. Discharges from the drain are into a natural channel whose sides are protected by concrete walls about 25 feet long. About 30 feet downstream from the drain outlet, the reservoir drain channel joins the spillway channel (See Photograph 7). The channel continues downstream (Dry Brook) to a water supply storage pond.

b. Location

The dam is located about 0.75 mile from the intersection of East Main Street and Mountain Avenue in the City of Beacon.

c. Size Classification

The dam is 35 feet high and has a reservoir capacity of 575 acre-feet. Therefore, the dam is classified as "small".

d. Hazard Classification

The dam is in the high hazard potential category because 3000 feet downstream from the dam is located the City of Beacon. There are several homes, a water supply filtration plant, and a water supply storage tank.

e. Ownership

Mt. Beacon Dam is owned by the City of Beacon, 427 Main Street, Beacon, New York, 12508, Tel. No. (914) 831-0932. The person to contact is Mr. Mark Giodano, Superintendent of Water Department.

f. Purpose of Dam

The impoundment provided by the dam is used for water supply. It is reported that the impoundment supplies about 20 percent of the city's water supply.

g. Design and Construction History

Original design and construction records are not available. It is reported that the dam was built in 1889. According to a dam section shown on the available drawing of 1913 (Plate No. 3 in Appendix A), it appears that the original dam was a rubble masonry concrete dam and later was raised and concrete buttresses added. The drawing and available information also proposed the strengthening of the downstream face of each buttress by providing a 3 foot thick concrete strut. The construction records of these repairs could not be located. The available drawings of 1922 (Plates 4 through

6 in Appendix A) proposed the following modifications to the dam. The construction records of these modifications could not be located.

a. The masonry gravity section between the buttresses to be strengthened by placing concrete struts and seepage drains installed between the masonry and concrete struts.

b. The geometry of the stepped downstream face of the spillway to be modified to "ogee shaped".

c. The new spillway channel walls to be relocated to accommodate the spillway modification.

d. The upstream face of the dam to be surfaced with "gunite".

It is reported that the upstream gate valve for the reservoir drain was added subsequent to the original construction; the date is unknown. Also, it is reported that the entire dam was surfaced with gunite in 1978.

h. Normal Operating Procedures

The flow from the reservoir is from the spillway and/or reservoir drain. It is reported that 300,000 gallons of water per day are released from the reservoir through either the reservoir drain or the reservoir drain and spillway.

1.3 PERTINENT DATA

a. Drainage Area, Square Miles	0.25
b. Discharge at Dam, cfs	
Maximum Known Flood at Site	Unknown
Ungated Spillway at Maximum Pool	210
Reservoir Drain	67.5
c. Elevation, Feet Above MSL	
Top of Dam, Feet	1286.5
Spillway, Feet	1285.0
d. Reservoir	
Length of Normal Pool, Feet	1300
Surface Area of Maximum Pool, Acres	20.7
Surface Area of Normal Pool, Acres	20
e. Storage, Acre-Feet	
Spillway Crest	575
Top of Dam	606

f.	Dam	
	Type	Masonry Concrete Gravity Section and Concrete Buttress
	Length (Feet)	350
	Height (Feet)	35
	Crest Width (Feet)	8.5
	Side Slopes	
	Upstream	7V:1H
	Downstream	0.37V:1H
g.	Spillway	
	Type	Uncontrolled, Broad Crested
	Crest Width (Feet)	43+
	Slopes	
	Upstream	7V:1H
	Downstream	"Ogee Shaped"
h.	Reservoir Drain	
	Type	22-Inch
	Controls	Upstream and Downstream Manually Operated Gate Valves

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

Mt. Beacon Reservoir is located in the western portion of the New England Uplands physiographic province of New York State. The durable Precambrian rocks of this area are reflected in the landforms of significant topographic relief. The rocks at the reservoir site include hornblende granite gneiss with subordinate lencogranite.

2.2 SUBSURFACE INVESTIGATION

No subsurface investigation could be located for the project. However, surface cover in the vicinity of Mt. Beacon Reservoir is described as "Rockland" (Refs. 9 and 10). Rock outcrops, stones and steep slopes are characteristics of this area of very thin glacial till over bedrock.

2.3 DESIGN RECORDS

The dam is reported to have been constructed in about 1889. There are no design data or specific design memoranda available for the project features. However, there are four drawings, one dated November, 1913 (Plate 3 in Appendix A) and three dated July, 1922 (Plates 4 through 6 in Appendix A)obtained from the New York State Department of Environmental Conservation. The 1913 drawing shows the original dam cross section, a modified section, and the suggested method of strengthening the buttresses. The 1922 drawing shows the strengthening of the gravity section between buttresses, new geometry of downstream face of the spillway, the relocation of the spillway channel walls and the gunite surfacing of the upstream face. There are no construction records of the modification.

It is reported that the upstream gate valve was added to the reservoir drain and the entire dam was resurfaced by applying gunite in 1978. There are no construction records available of the addition of the valve and resurfacing.

2.4 CONSTRUCTION RECORDS

There are no construction records for the original dam or subsequent modifications available for the project.

2.5 OPERATION RECORDS

There are no available operation records for the project and gates. However, there are weekly records of the reservoir level kept at the Department of Public Works and the City Engineers Office. There are no rainfall readings

taken at the dam site. However, it is reported that rainfall readings are taken at Texaco Research Center, located 1.5 mile downstream from the dam.

2.6 EVALUATION OF DATA

Existing information was made available from the owner and the New York State Department of Environmental Conservation.

The information obtained from available data and the visual inspection is considered adequate for the Phase I inspection and evaluation.

There is one inconsistency in the available drawings: the July, 1922 drawing (Plate No. 6) indicates nine buttresses, whereas ten buttresses were observed during the visual investigation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of Mt. Beacon Reservoir was made on 24 July 1980. The weather was sunny with temperature at about 80°F. It was reported that rain occurred the previous night and the reservoir level was at about El 1281.5, 3.5 feet below the spillway crest.

b. Dam

The gunite surface on the bays (gravity sections) and buttresses appears to be in generally good condition. The horizontal and vertical alignment of the dam are uniform and there is no indications of movement. The crest and the upstream face above the waterline appears to be in good condition except at several locations, the gunite surface has hairline to 1/8 inch wide longitudinal, and transverse cracks. The downstream face of the dam appears to be in good condition. There are several hairline to 1/8 inch wide cracks in the gunite surface which are calcified and some of the cracks show evidence of seepage. There are seepage drain outlets located at different elevations on the downstream face of several bays. Some of the drains are active. The seepage was minor at all bays except at the third bay from the left abutment which was estimated at about 1.5 gpm.

At about 50 feet downstream from the toe of the dam and about 45 feet from the left abutment there is a saturated area caused by seepage. The source of the seepage could not be determined. The flow is estimated to be about 4 to 5 gallons per minute, with no signs of migration of fines.

The entire area downstream from the toe of the dam is covered with overgrown grass, bushes and saplings (See Photograph No. 3).

c. Spillway

The spillway appears to be in good condition except minor cracking of the gunite surface at the crest and the downstream face. The entire right abutment spillway contact which is bedrock was saturated as a result of seepage. The source of seepage could not be determined. The flow is estimated to be about 1 gallon per minute, but there are no signs of migration of fines.

d. Appurtenant Structures

The upstream and downstream gate valves of the reservoir drain were operated during the inspection. The reservoir drain and both regulating gate valves are in good operating condition.

At the outlet of the reservoir drain there are five (5) pipes of varying diameters (See Photograph No. 6). The purpose and upstream extent of these pipes could not be determined, nor could anyone explain their purpose.

e. Abutments

There is a low area at the left abutment and it is about 2 inches lower than the level of the dam crest (See Photograph No. 12). Otherwise, there are no signs of seepage or other unusual conditions. At the right abutment except for the seepage mentioned in Section 3c, there are no signs of unusual conditions.

f. Downstream Channel

The spillway and reservoir drain channels join at about 10 feet from the dam to form a downstream channel which consists of boulders and bedrock. The spillway channel floor is bedrock and is overgrown with trees, bushes and saplings. The reservoir drain channel whose sides are protected by concrete walls, appears to be in good condition except the walls are spalled at several locations. The right wall of the reservoir drain channel, where the spillway and reservoir drain channel join, is undermined (See Photograph No. 7).

g. Reservoir Area

In the vicinity of the dam there is no evidence of sloughing, potentially unstable slopes or other unusual conditions which would adversely effect the dam. No evidence of excessive sedimentation was observed. The reservoir was relatively clean.

3.2 EVALUATION OF OBSERVATIONS

The visual observations made during the course of the investigation revealed several deficiencies which at present do not adversely affect the adequacy of the dam. However, these deficiencies do require attention and should be corrected. The following is a summary of the problem areas encountered, in order of importance, with appropriate recommended actions:

1. Establish a systematic program to observe and monitor changes in seepage occurring at the outlets of the seepage drains located on the downstream face of the gravity sections.

2. Low area at the left abutment should be backfilled with concrete to the level of the crest of the dam.

3. Determine the sources of seepage occurring at the spillway right abutment contact, and in the vicinity near the left abutment downstream from the toe of the dam. Monitor the seepage biweekly with the aid of weirs.

4. The vegetation in the spillway channel and the area downstream from the toe of the dam should be removed. Provide a program of periodic cutting and mowing of these areas.

5. Repair the side walls of the spillway and the reservoir drain channels.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The flow from the reservoir is over the spillway and/or through the reservoir drain. It is reported that depending upon inflow, 300,000 gallons of water per day are released from the reservoir either through the reservoir drain or over the spillway.

4.2 MAINTENANCE OF THE DAM

The dam is maintained by the owner. It is reported that the dam is "looked at" once a week by the owner's maintenance crew. However, maintenance of the dam is considered inadequate as evidenced by the growth of vegetation in the spillway channel; downstream from the toe of the dam; seepage at the right abutment contact and the condition of the spillway and reservoir channel walls.

4.3 WARNING SYSTEM IN EFFECT

There is no warning system in effect or in preparation.

4.4 EVALUATION

The dam and appurtenances have not been maintained in satisfactory condition as noted in Section 3, "Visual Inspection".

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Mt. Beacon Reservoir is located about one mile east of Beacon, in Dutchess County, New York, Hydrologic Unit Code 02020008. The watershed, contributing to the reservoir, is 0.25 square mile and consists entirely of steep wooded slopes with peaks above El 1500. There are no defined stream channels in the basin as determined from the 1957 West Point Quadrangle (See Topograhic Map in Appendix A) and there was no land development observed at the time of the inspection.

5.2 ANALYSIS CRITERIA

The analysis of the spillway capacity of this dam was performed using the U.S. Army Corps of Engineers HEC-1 DB computer program (Ref. 1).

Because of the small drainage area and steep slopes, (from 0.10 to 0.36 feet per foot) it was assumed that the runoff equals excess rainfall. Rainfall losses over the land area were assumed to be constant at 0.1 inch per hour after an initial loss of 0.2 inch. No losses were deducted for rain falling directly on the reservoir. A Probable Maximum Flood (PMF) peak of 1480 cfs was computed from the 24 hour, 200 square mile Probable Maximum Precipitation of 22 inches (Ref. 2).

5.3 SPILLWAY CAPACITY

The uncontrolled spillway is 43.32 feet long, with a crest width of 8.0 feet, at El 1285, 1.5 feet below the top of the dam. The maximum discharge capacity of the spillway with water level at El 1286.5 (top of dam) is 210 cfs. The discharge through the 22-inch diameter reservoir drain is 67.5 cfs with a head of 20.0 feet.

5.4 RESERVOIR CAPACITY

The normal capacity of Mt. Beacon Reservoir is reported to be 575 acre-feet at the spillway crest, El 1285. The computed surcharge storage, between El 1285 and El 1286.5 (top of dam) is 31 acre-feet, which is equivalent to about 2.3 inches of runoff over the entire basin. The maximum capacity of the reservoir is 606 acre-feet.

5.5 FLOODS OF RECORD

There are no records available of floods. However, there are weekly records of the reservoir levels available at the Department of Public Works and City Engineers Office.

5.6 OVERTOPPING POTENTIAL

The potential of the dam being overtopped was investigated on the basis of the spillway discharge capacity and the available surcharge storage to meet the selected design flood inflows. Analysis indicates the spillway does not have sufficient capacity to pass the outflow from one-half the PMF, and overtopping would occur for all storm events exceeding 16 percent of the PMF.

The PMF, routed through the reservoir, resulted in peak outflow of 1293 cfs, and a corresponding maximum water surface El 1287.35, 0.85 feet above the top of the dam. One-half the PMF routed through the reservoir resulted in peak outflow of 572 cfs, and a corresponding maximum water surface El 1286.96, 0.46 feet above the top of dam.

5.7 EVALUATION

The dam does not have sufficient spillway capacity to pass either the PMF or one-half the PMF without overtopping of the dam. The overtopping could cause the failure of the dam, thus significantly increasing the hazard to loss of life downstream. Therefore, the spillway is assessed as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation

Visual observation did not indicate conditions which would affect the structural stability of the dam. The observed seepages at the downstream face of the gravity sections and at the spillway right abutment contact and downstream from the toe of the dam in the vicinity of the left abutment are not detrimental to the stability or safety of the dam at the present time.

b. Design and Construction Data

The original preconstruction design computations regarding the structural stability of the dam are not available.

c. Operating Records

It is reported there are available records of the reservoir levels from 1960 to date at the Water Department. There are no records of the gate operation available. No major operation problems which would affect the stability of the dam were reported.

d. Post-Construction Changes

There are no recorded post-construction changes. However, there are four drawings, one dated November, 1913 (Plate 3 in Appendix A) and another three dated July, 1922 (Plates 4 through 6 in Appendix A) obtained from the New York State Department of Environmental Conservation. The 1913 drawing shows the original dam cross section, the modified section, and the suggested method for strengthening the buttresses. The 1922 drawing shows the strengthening of the gravity sections between buttresses, new geometry of downstream face of the spillway, the relocation of the spillway channel walls and the gunite surfacing of the upstream face. There are no construction records of the modifications.

It is reported that the upstream gate valve was added to the reservoir drain and the entire dam was resurfaced with gunite in 1978. There are no construction records of the addition of the valve and the resurfacing.

e. Seismic Stability

According to the recommended Corps guidelines, the dam is located in Seismic Zone No. 1. However, based on past earthquake history, the New York State Geological Survey considers the dam site to be in Zone 2. Based on this assessment, the dam is considered to be in Seismic Zone 2. The results of the seismic stability are described in Section 6.2.

6.2 STRUCTURAL STABILITY ANALYSIS

Structural stability analyses for a non-overflow section and spillway section were performed. The results of the analyses are as follows:

NON-OVERFLOW SECTION

Case	Loading Condition	Location of Resultant	Sliding F.S. (See Appendix E)
a	Normal loading condition, reservoir level at spillway crest, no ice load	Outside middle third	1.21
b	Normal loading condition, reservoir level at spillway crest, with ice load	Outside middle third	1.06
c	Unusual loading: flood level equal to 1/2 PMF	By comparison with Case a, the results are relatively the same	
d	Extreme loading: flood level equal to PMF	By comparison with Case a, the results are relatively the same	
e	Unusual loading: reservoir level at spillway crest, and earthquake forces	Outside Middle Half	1.04

OVERFLOW SECTION (SPILLWAY)

Case	Loading Condition	Location of Resultant	Sliding F.S. (See Appendix E)
a	Normal loading condition, reservoir level at spillway crest, no ice load	Within Middle Third	2.64
b	Normal loading condition, reservoir level at spillway crest, with ice load	Within Middle Third	1.83
c	Unusual loading: flood level equal to 1/2 PMF	Within Middle Half	2.04
d	Extreme loading: flood level equal to PMF	By comparison with Case c, the location of the resultant and the sliding F.S. almost the same	
e	Unusual loading: reservoir level at spillway crest, and earthquake forces	Within Middle Third	2.07

The results of the stability analyses indicate that stability of the non-overflow section of the dam against overturning and sliding are inadequate for all loading conditions. However, the stability of the spillway section against overturning and sliding are adequate for all loading conditions.

It is therefore recommended that a more detailed structural stability analyses be performed. Field investigations should be carried out to obtain additional information regarding the uplift pressure within and under the base of the non-overflow section, the quality of the foundation, the geometry and extent of the non-overflow structure, and the condition of the non-exposed concrete. The information should then be incorporated into a more detailed structural stability evaluation.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

Examination of the available documents and visual inspection of Mt. Beacon Reservoir Dam and appurtenant structures did not reveal any conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms which exceed approximately 16 percent of the Probable Maximum Flood (PMF). The overtopping of the dam could cause dam failure, thus significantly increasing the hazard to the loss of life downstream. The spillway is therefore adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency. The structural stability analyses based on available information and visual inspection indicates that the stability against overturning and sliding for the overflow section of the dam is adequate whereas for the non-overflow section is inadequate.

b. Adequacy of Information

The information and data available were adequate for performance of this investigation.

c. Need for Additional Investigations

Since the spillway is considered to be "seriously inadequate", additional hydrologic/hydraulic investigations are required to more accurately determine the site specific characteristics of the watershed. After the in-depth hydrologic/hydraulic investigations have been completed, remedial measures must be initiated to provide spillway capacity sufficient to discharge the outflow from the one-half PMF event. In addition, an investigation of the structural stability of the non-overflow section of the dam is required.

d. Urgency

The additional hydrologic/hydraulic and structural stability investigations which are required must be initiated within 3 months from the date of notification. Within 12 months of notification, remedial measures as a result of this investigation must be initiated, with completion of this measure during the following year. In the interim, develop an emergency action plan for the notification of downstream residents and proper around-the-clock surveillance of the dam during periods

of extreme runoff. The other problem areas listed below must be corrected within one year from notification.

7.2 RECOMMENDED MEASURES

1. Establish a systematic program to observe and monitor changes in seepage occurring at the outlets of the seepage drains located on the downstream face of the geometry section.

2. Backfill low area at the left abutment with concrete to the level of the crest of the dam.

3. Determine the sources of seepage occurring at the spillway right abutment contact, and in the vicinity of downstream from the toe of the dam near the left abutment. Monitor the seepage biweekly with the aid of weirs.

4. Remove the vegetation in the spillway, and the area downstream from the toe of the dam. Provide a program of periodic cutting and mowing of these areas.

5. Repair the side walls of the spillway and reservoir channels.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

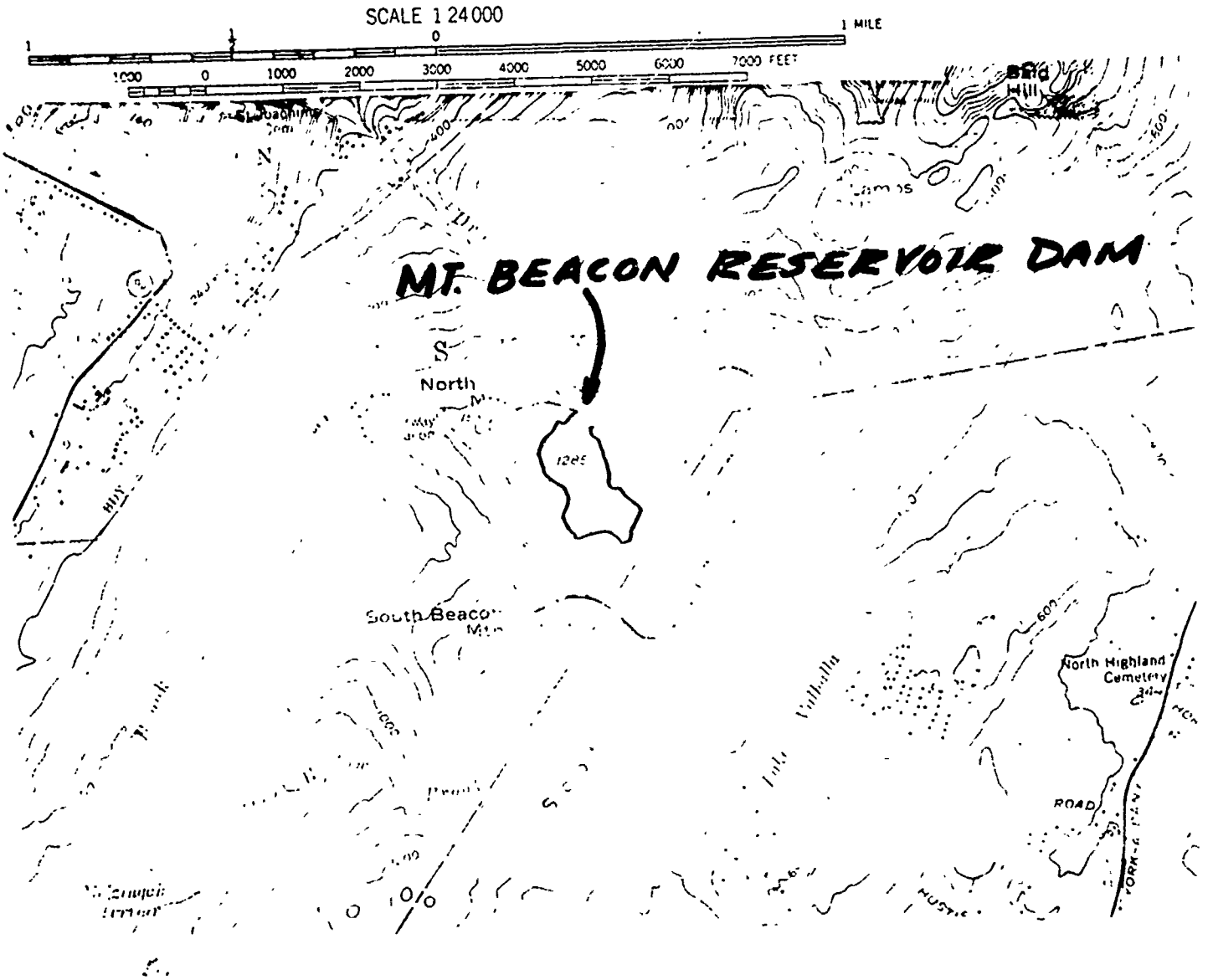
DRAWINGS

APPENDIX A

VICINITY MAP
MT. BEACON RESERVOIR DAM

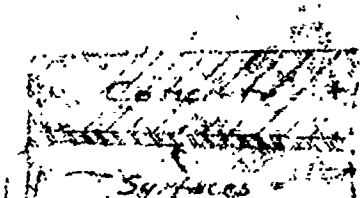
PLATE 1

WEST POINT QUAD
New York



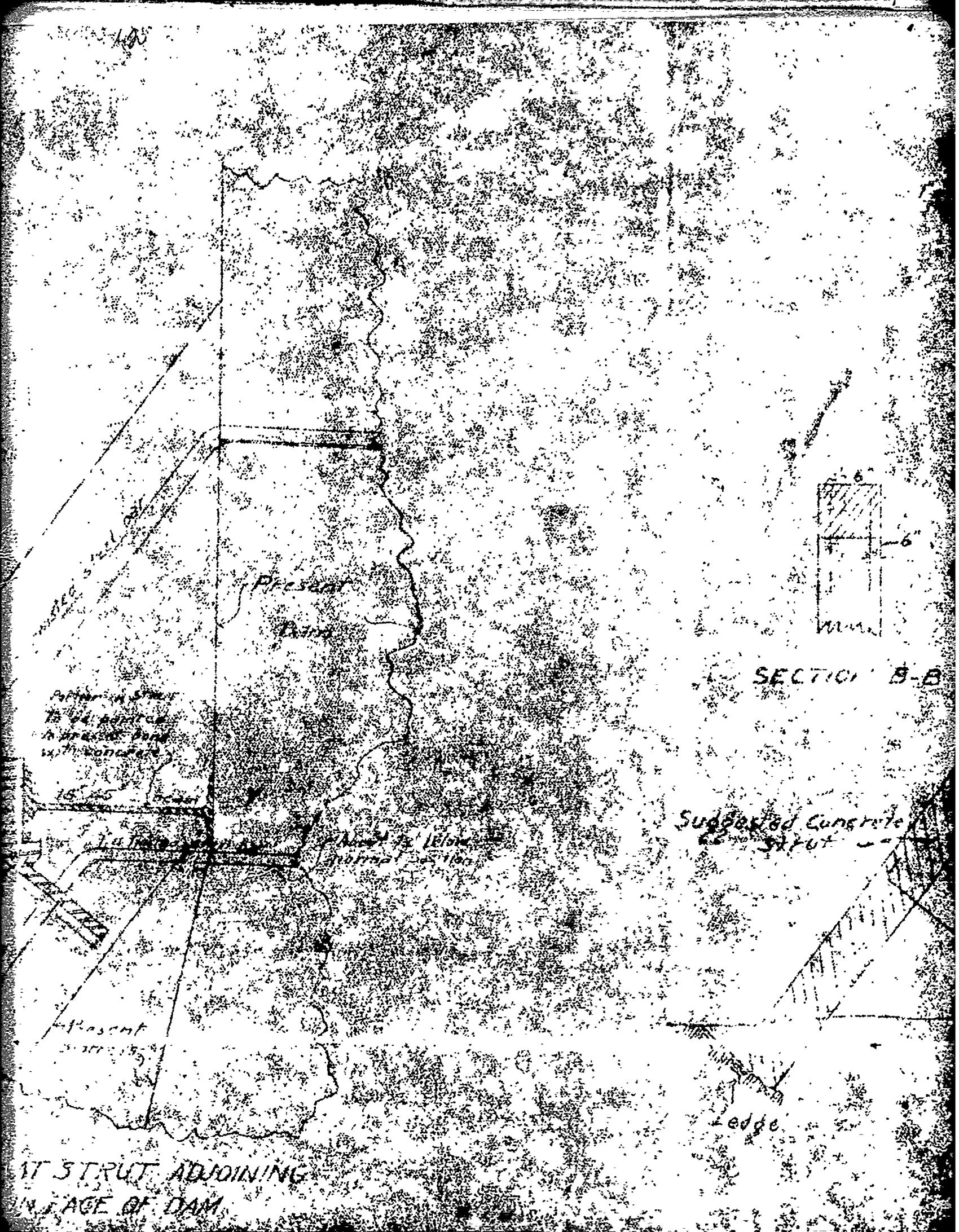
TOPOGRAPHIC MAP
MT. BEACON RESERVOIR DAM

PLATE 2



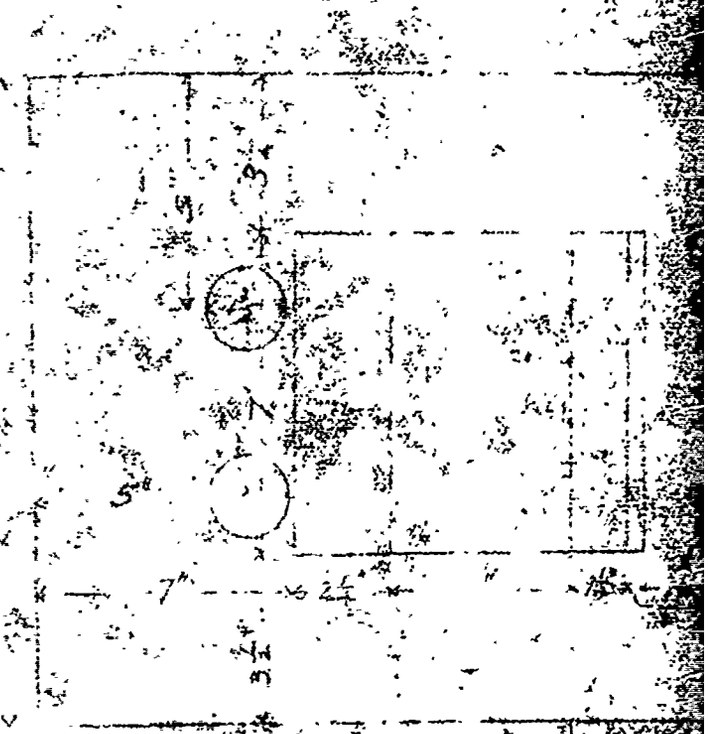
SECTION ON T BEAM
BETWEEN BUTTRESSES

DETAIL IT STRU
CRACKS / AGE


6"
6"
SECTION B-B
Present
Dam
Suggested Concrete
Slope
Ledge
17 STREET ADJOINING
VILLAGE OF DAM


PART SECTION
A-A
SECTION B-B
Present Bottom
Original Bottom
Concrete
SECTION AT MAXIMUM
SUGGESTED METHOD

DETAIL OF STRUT
CRACK VIEW OF



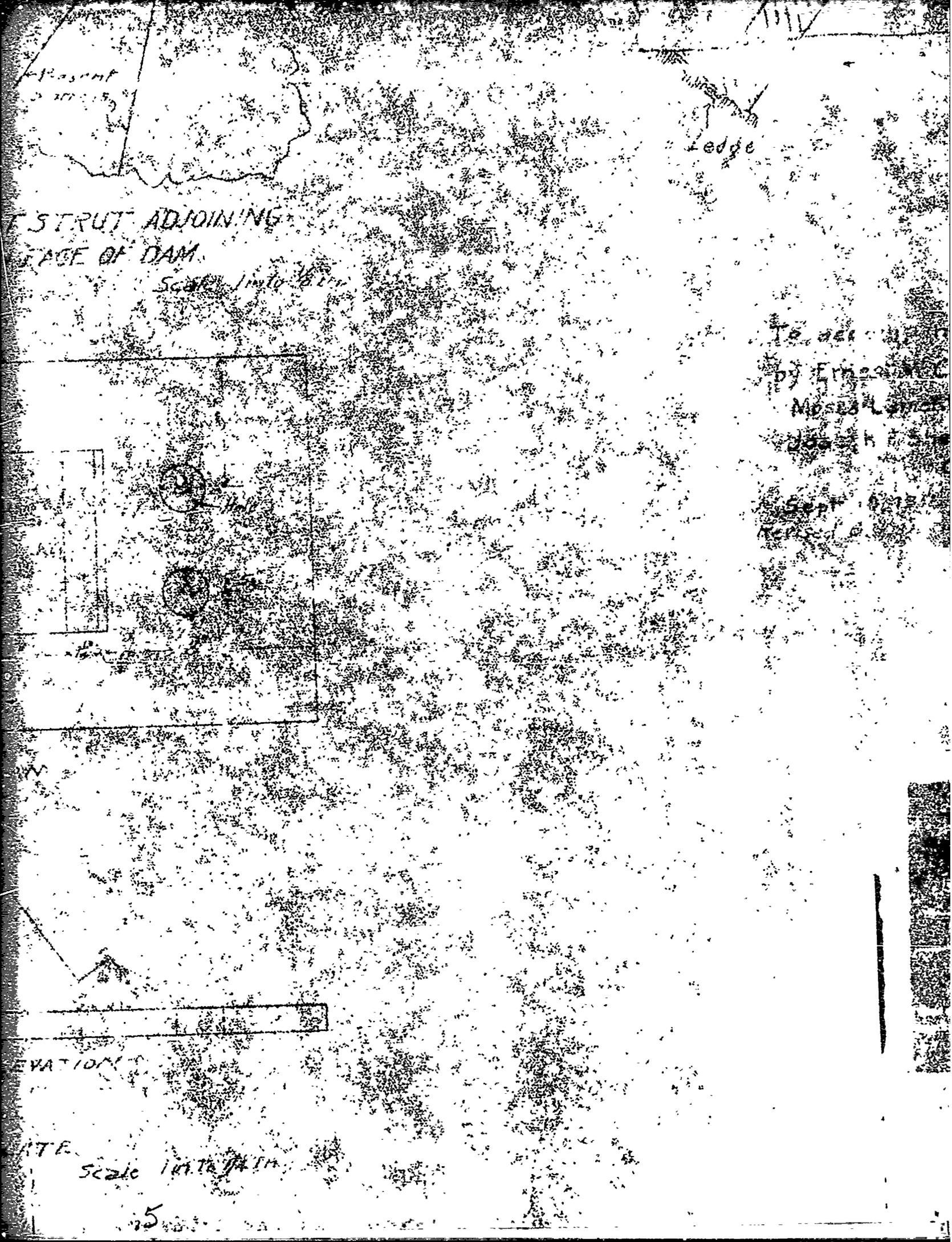
PLAN

END ELEVATION

SIDE ELEVATION

CAST IRON BEARING PLATE

Scale


Ledge
T STRUT ADJOINING
AGE OF DAM.
Scale 1 inch to 8 ft.
Hole
ATION
TE.
Scale 1 in. to 1/4 in.

SECTION AT MAX...

SUGGESTED METHO...
STRENGTHENING BEAC...

To accompany report
by Ern... Clarke ...
Moses ... Com. Accounts and
Joseph ... Sherman - Com. Public Works
City of B...
Dutchess Co. N.Y.

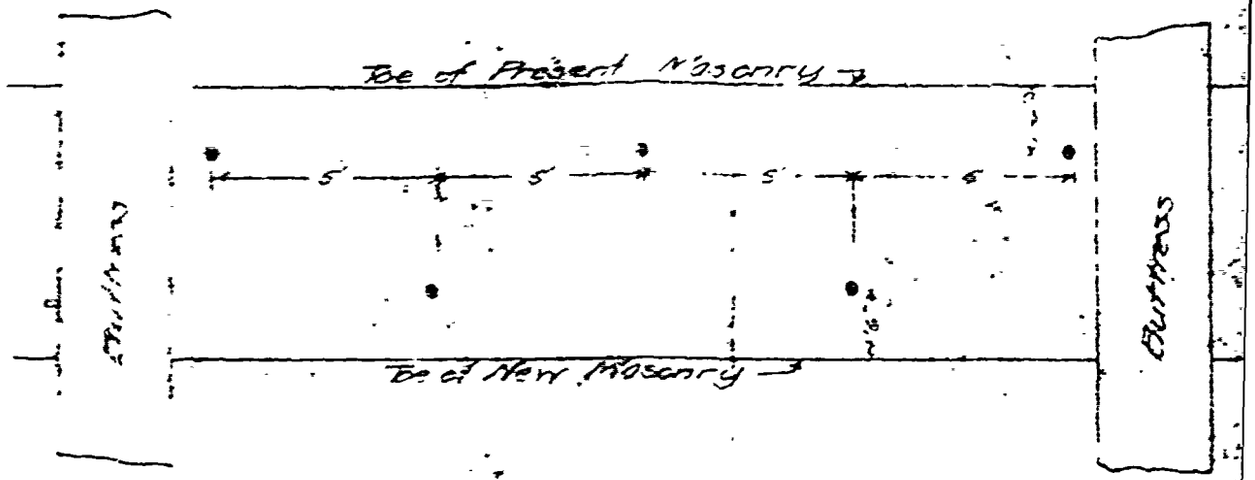
Sept ...
Revised ...

E. W. Cla...

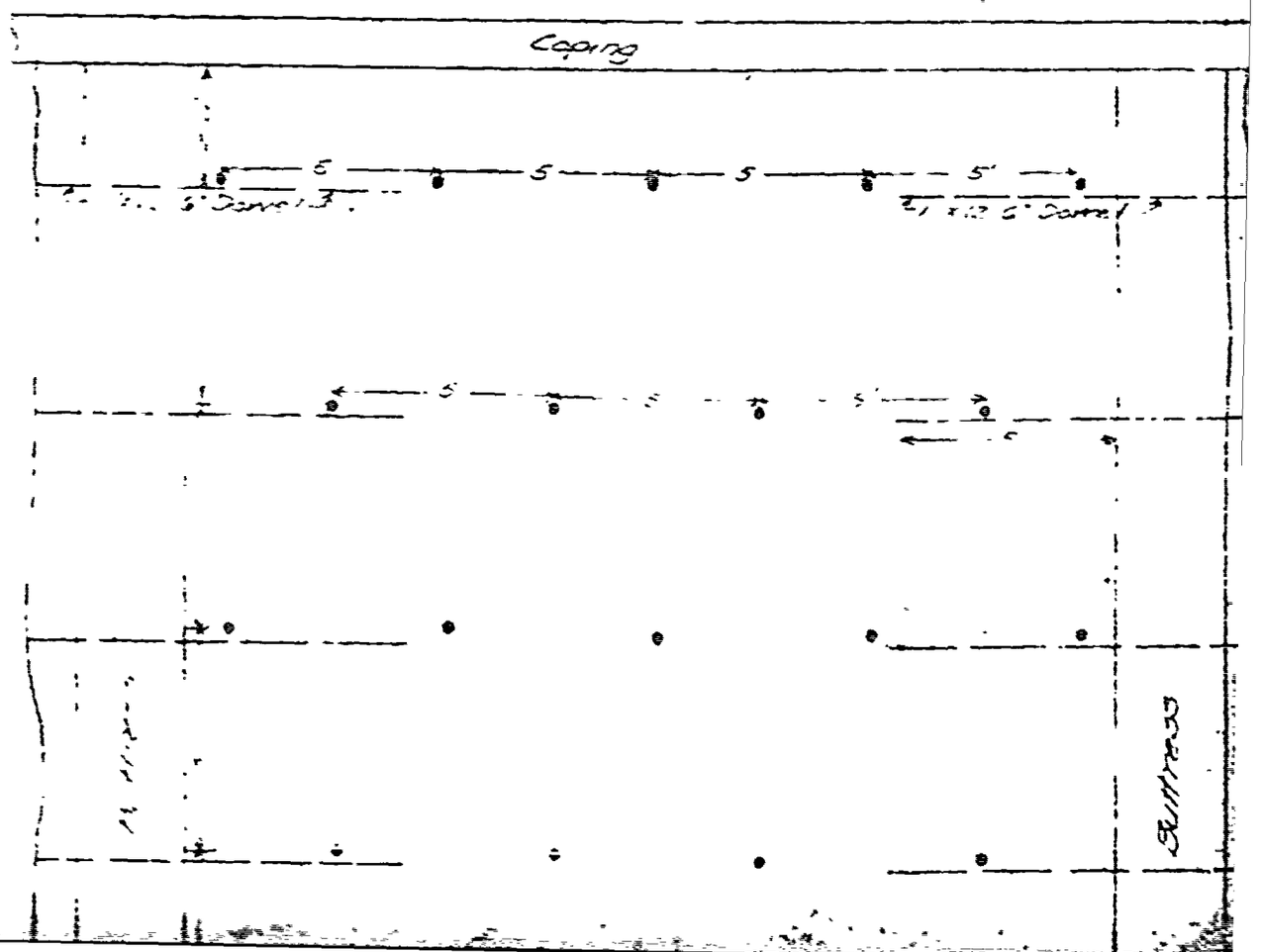
DIVISION OF ...
Albany ...
... this plan, with the accompanying specifications ...
... Hudson ... Watershed, have been ...

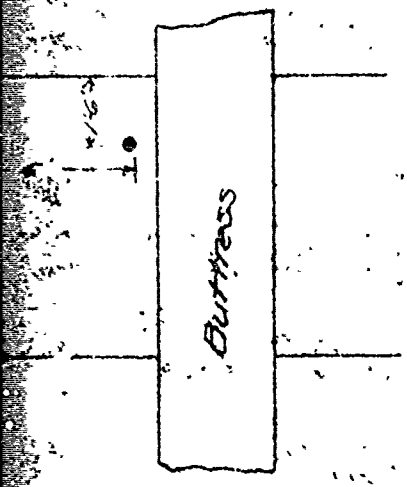
Albany, N.Y. ...
... by resolution of this Commission, under and in ...
... provisions of ... law, the above ...

6

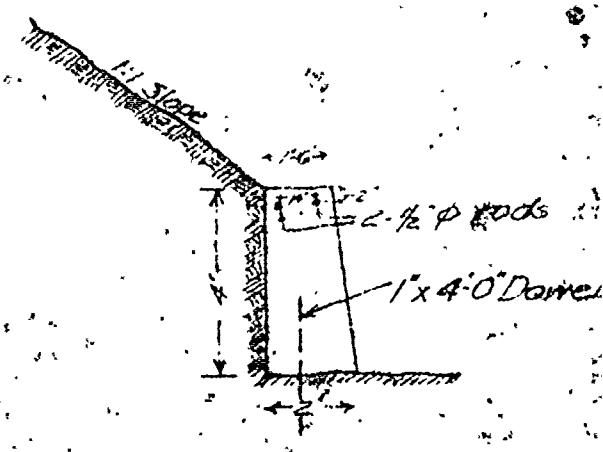


Dowels in Main Dam Footing
1½ x 8'-0" Dowels set 3'-0" in foundation rock





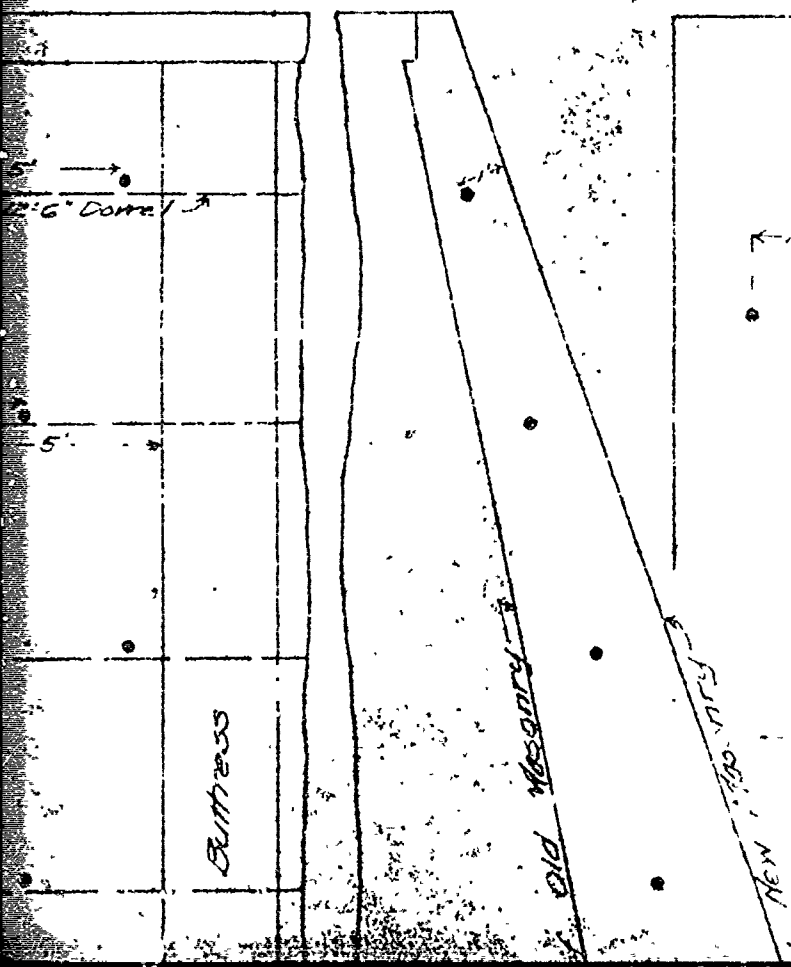
rock



Section of Canal Wall

Toe of Present

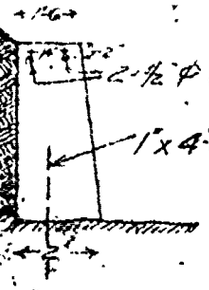
1½" x 8'-0" Dowels Sp



Toe of New Sp

Dowels in Spillwa

SHEET No 2.



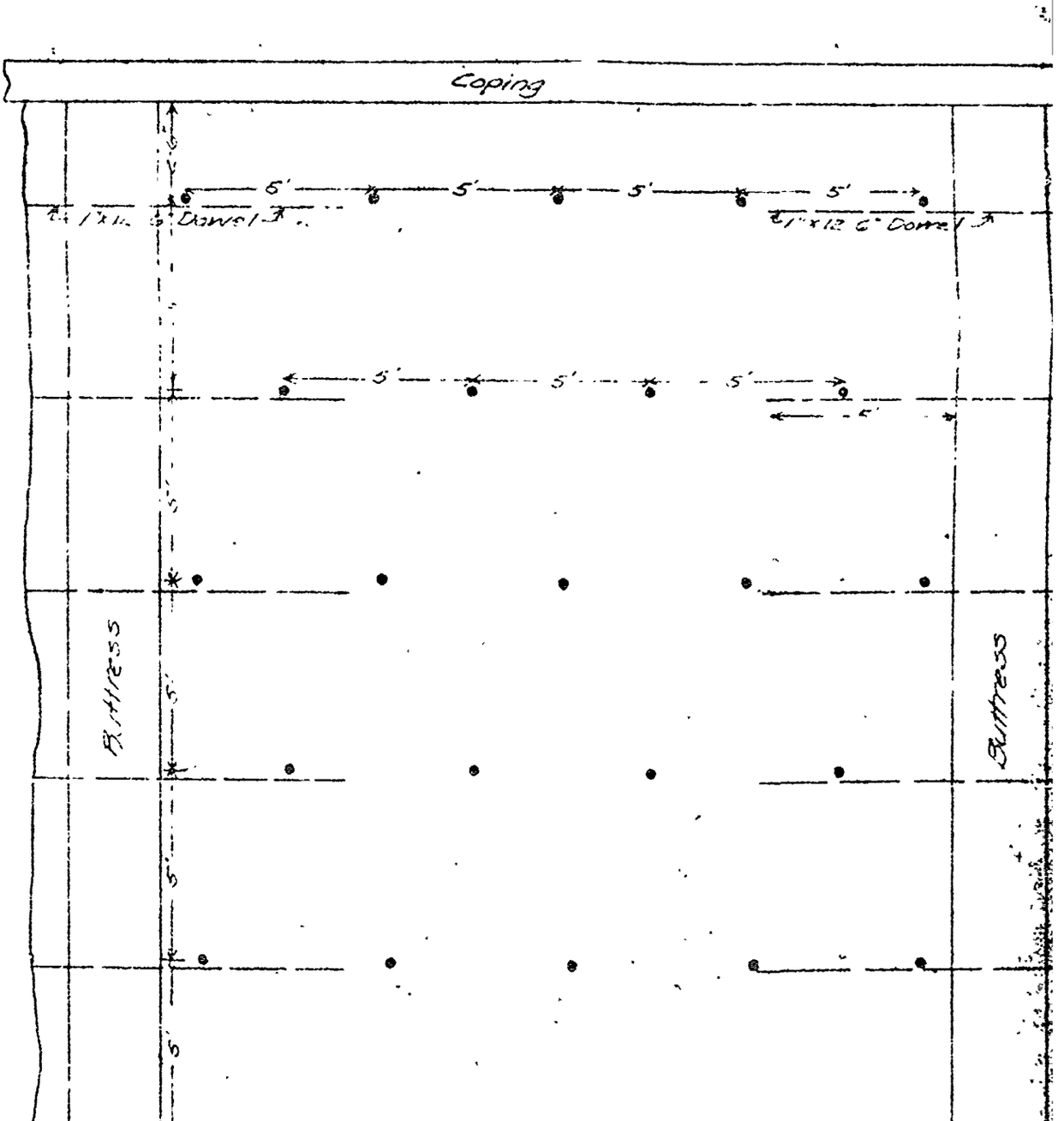
Toe of Canal Wall

Toe of Present Spillway

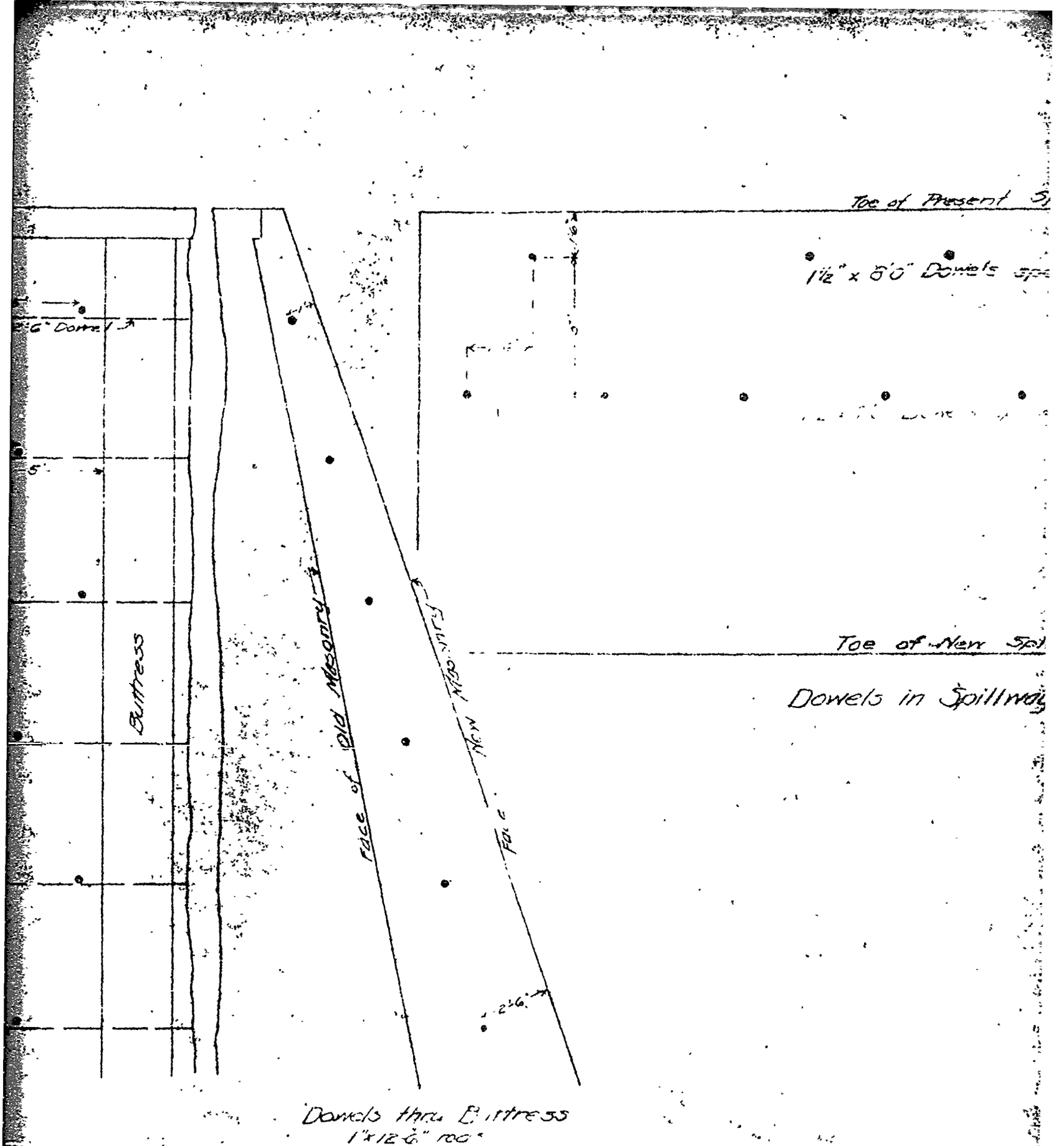
Spl... 1½" x 8'-0" Dowels spaced 5'-0" o.c.

Spl... Toe of New Spillway

...ing Dowels in Spillway Footing



Dowels in Face of Present Dam
1" Dowels, set 3-0" in the old masonry


Toe of Present Sp
1½" x 5'0" Dowels sp
6" Dowel
Buttress
Face of Old Masonry
Toe of New Spi
Dowels in Spillway
Dowels thru Buttress
1"x12'6" 100

Spillway Toe of Present Spillway

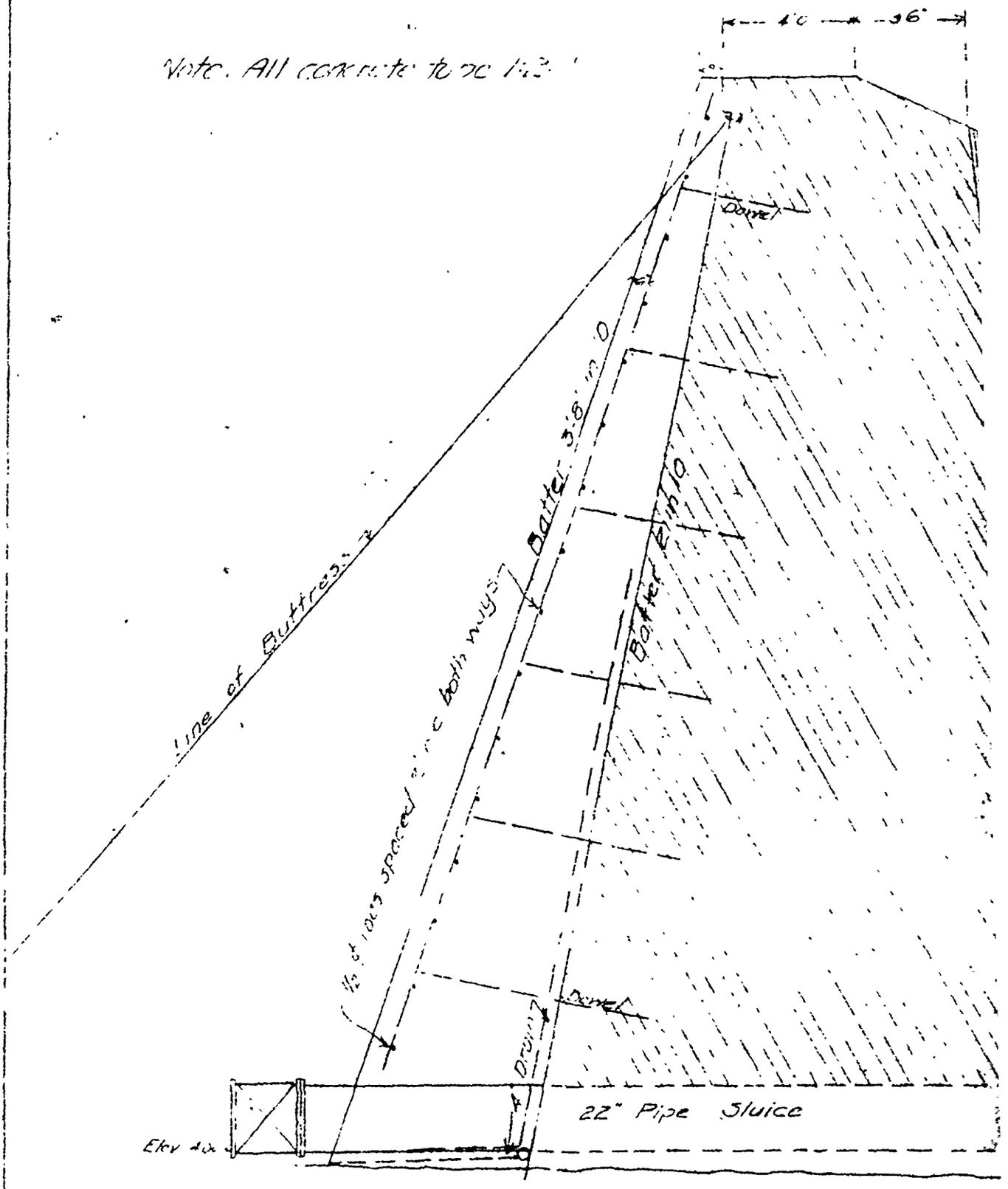
Spillway #4 x 8'0" Dowels spaced 5'0" o.c.

Spillway Toe of New Spillway

Spillway Dowels in Spillway Footing

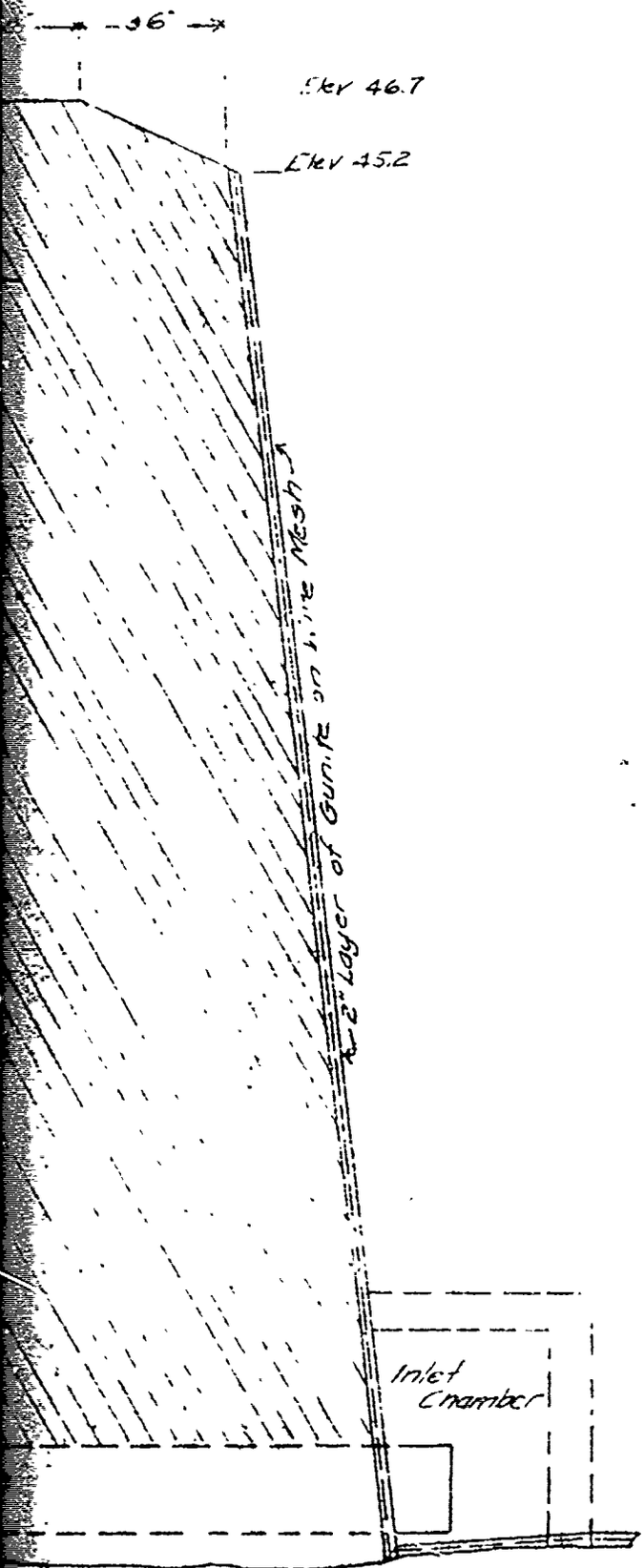
DAM AT STORAGE RESERVOIR
CITY OF BEACON
NEW YORK
Scale 1"=4'
George W. Krieger, Jr.

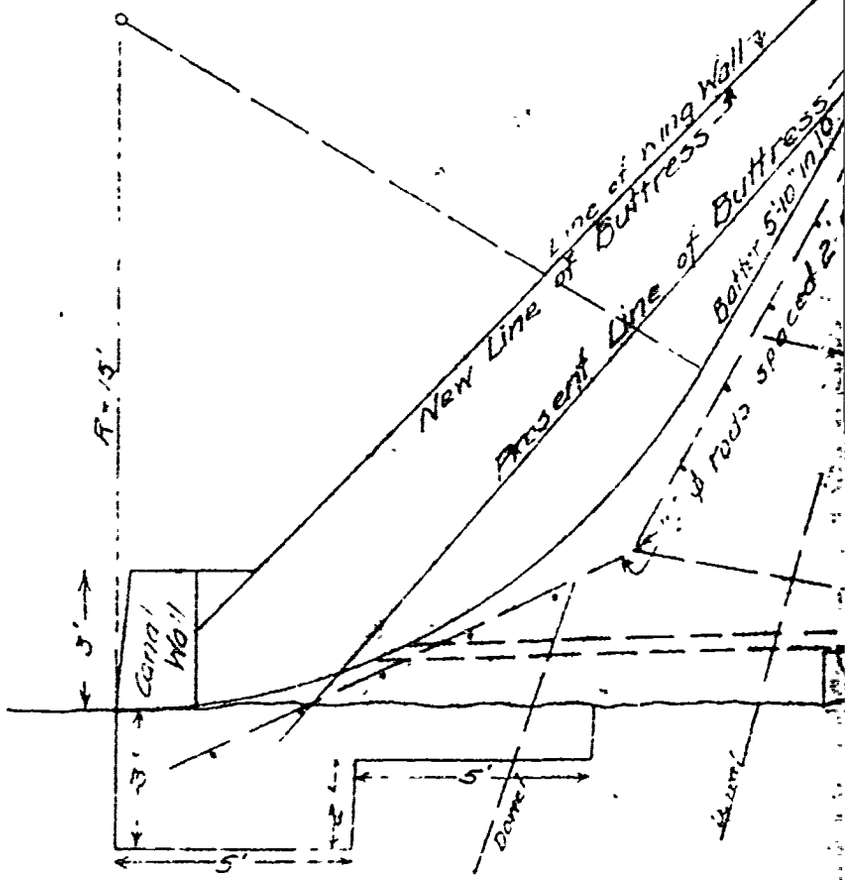
July 1962



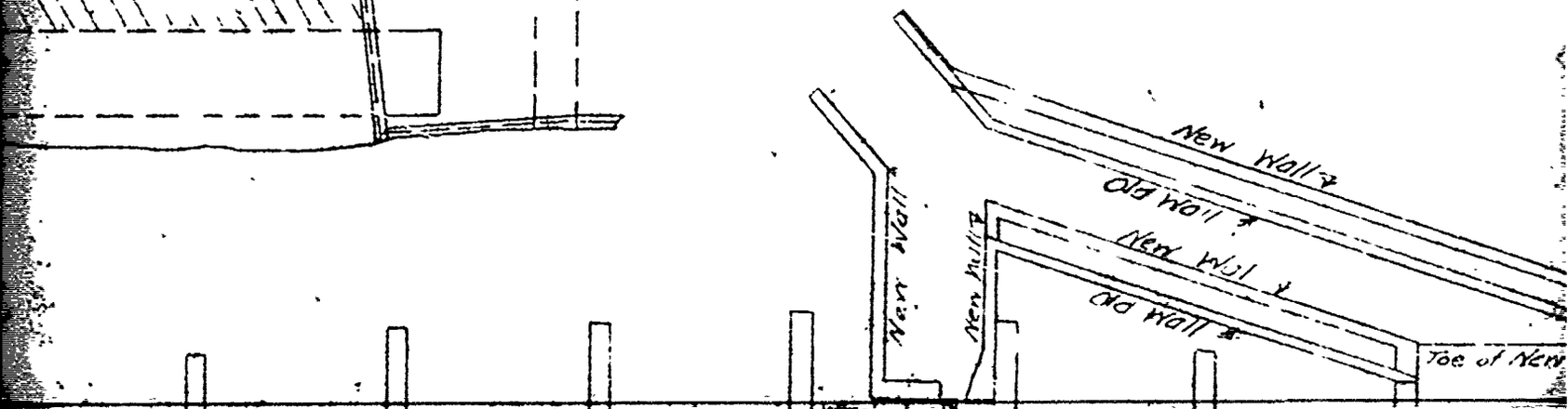
Typical Section
Scale 1"=4'

Note. For details of dowel spacing



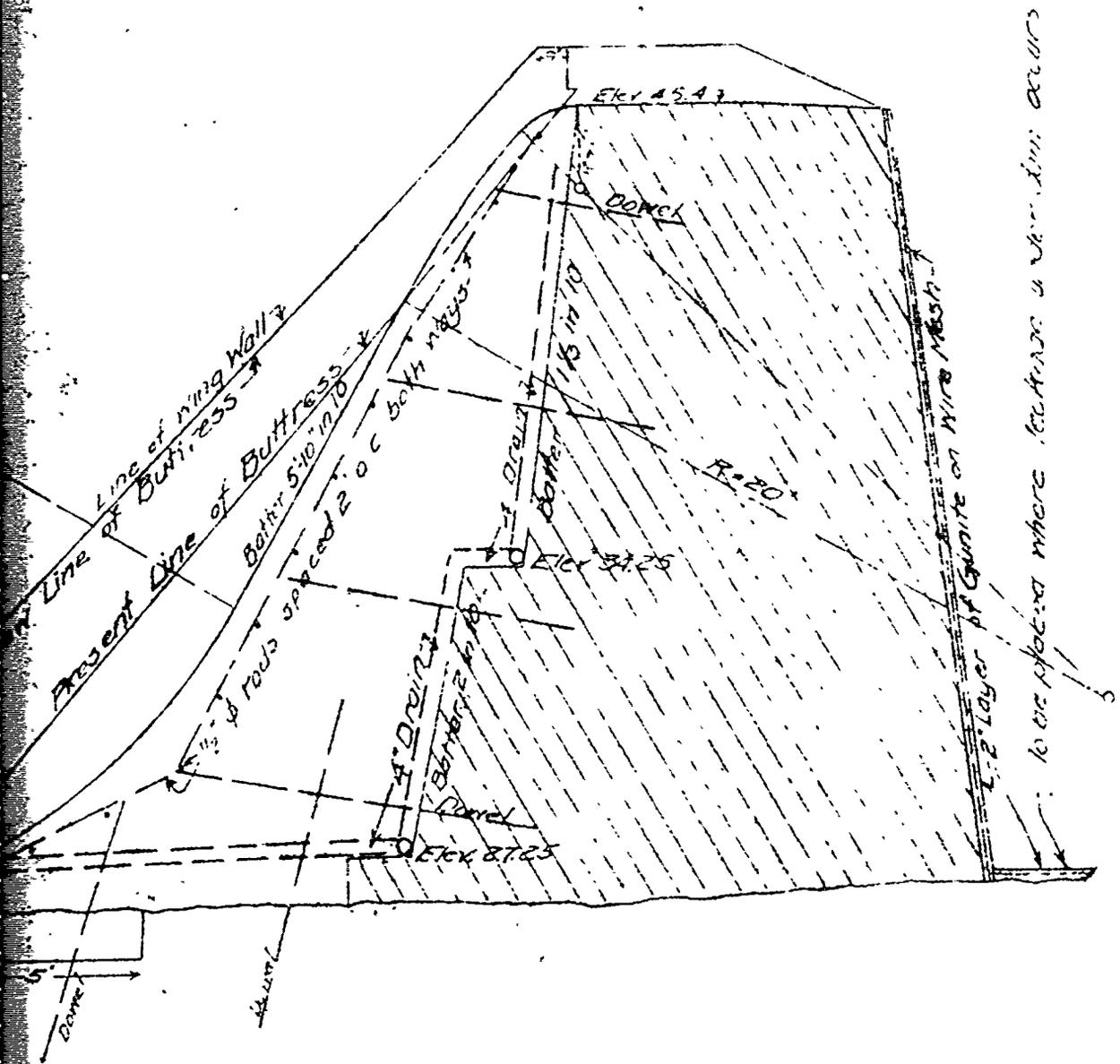


Section at West



SHEET No 1

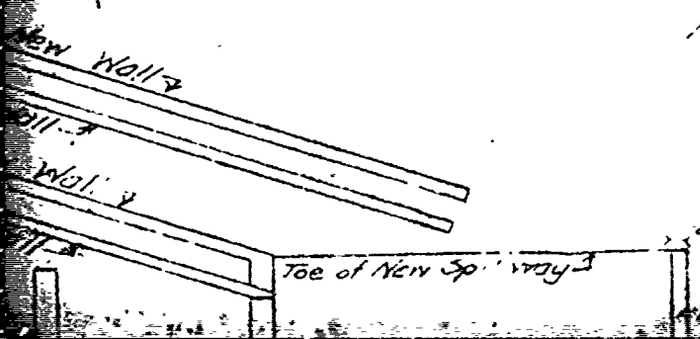
at dowel spacing see Sheet No 2



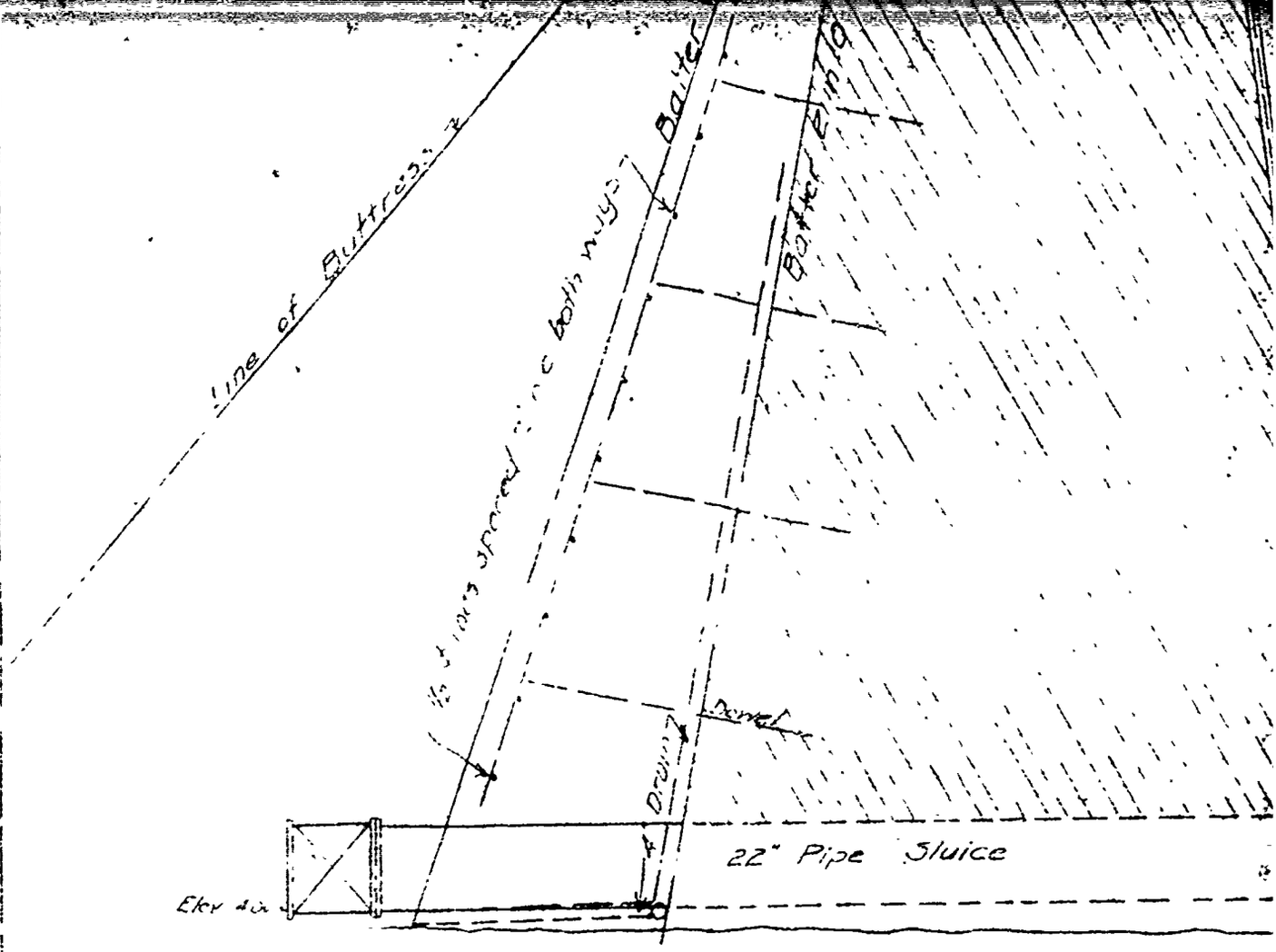
Section at West End of Spillway

Scale 1"=4'

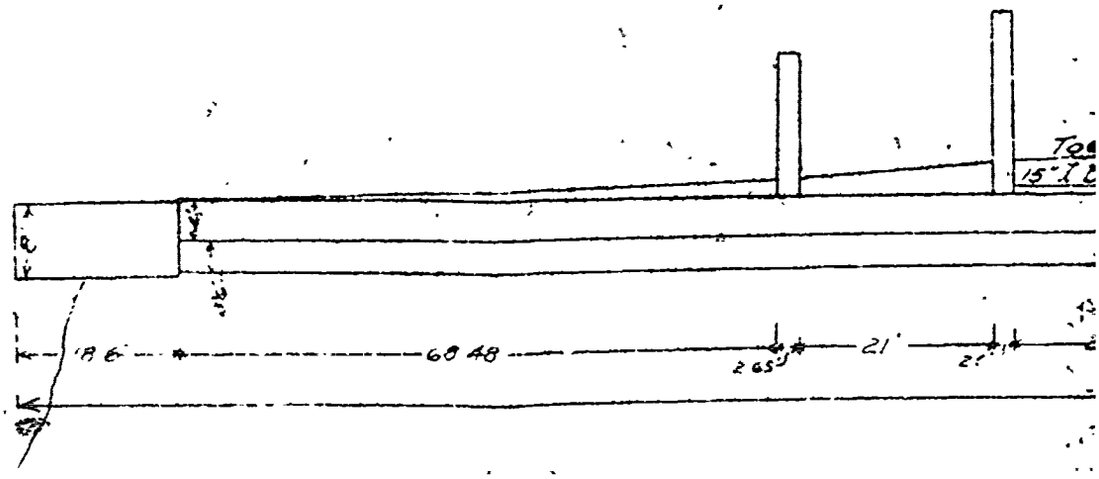
Note: Old walls to be removed.
New walls to be built as shown.

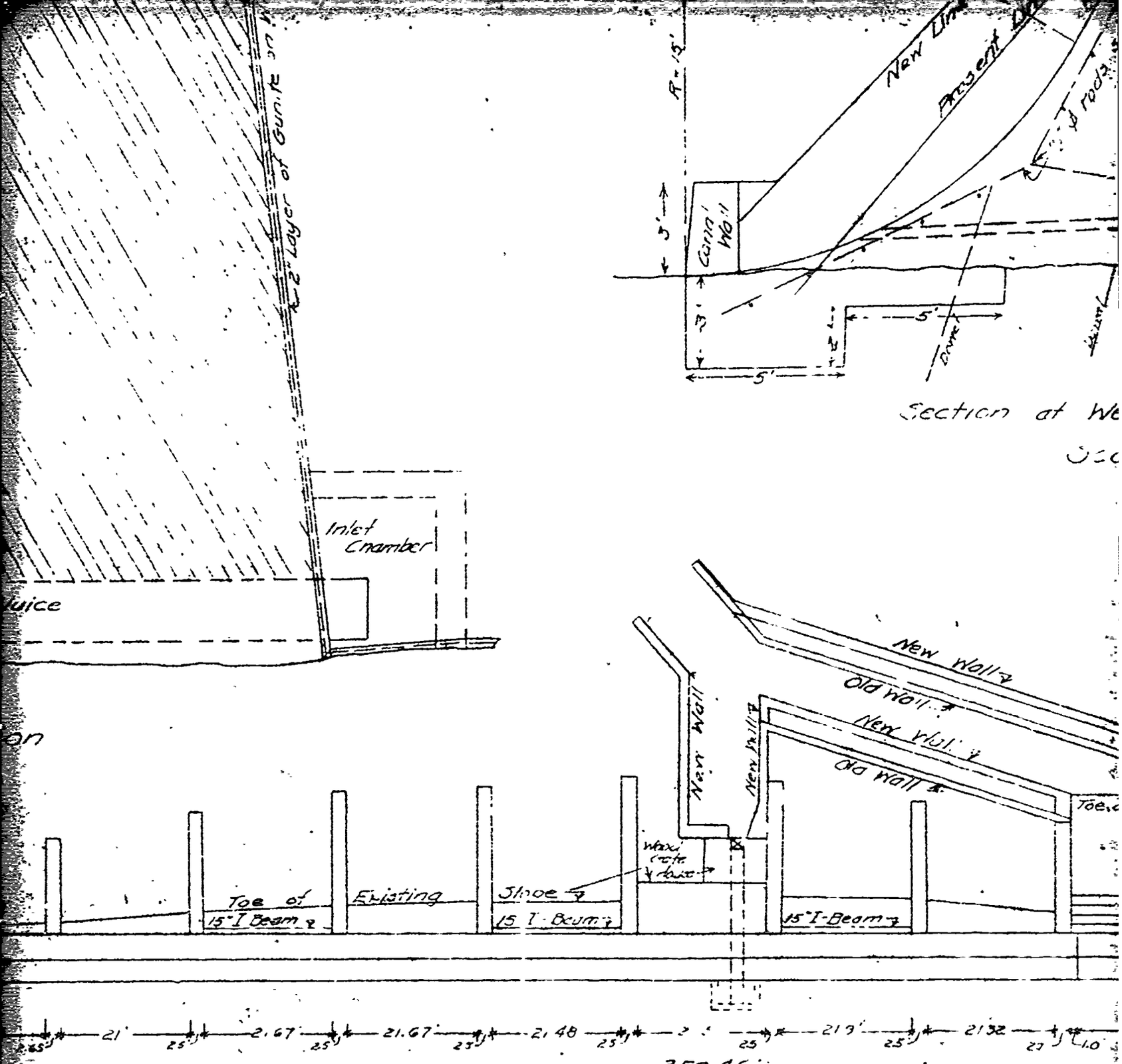


Wing Wall Reinforcement ½" ϕ rods 2'0" c both ways



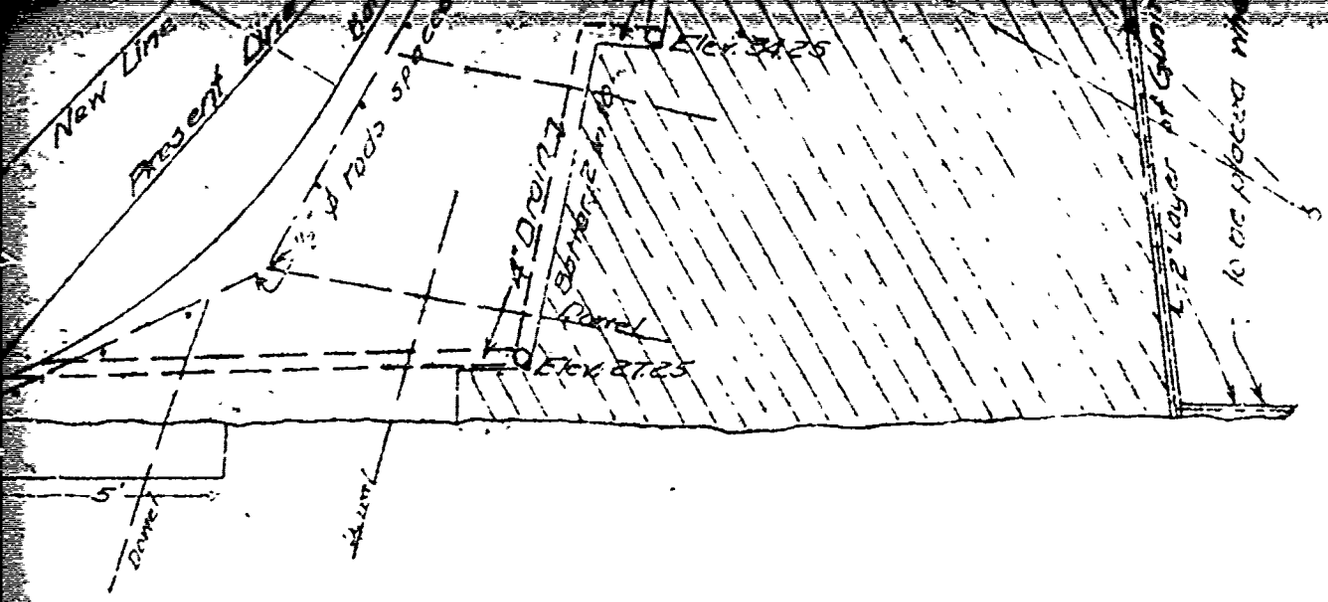
Typical Section
Scale 1"=4'





Plan

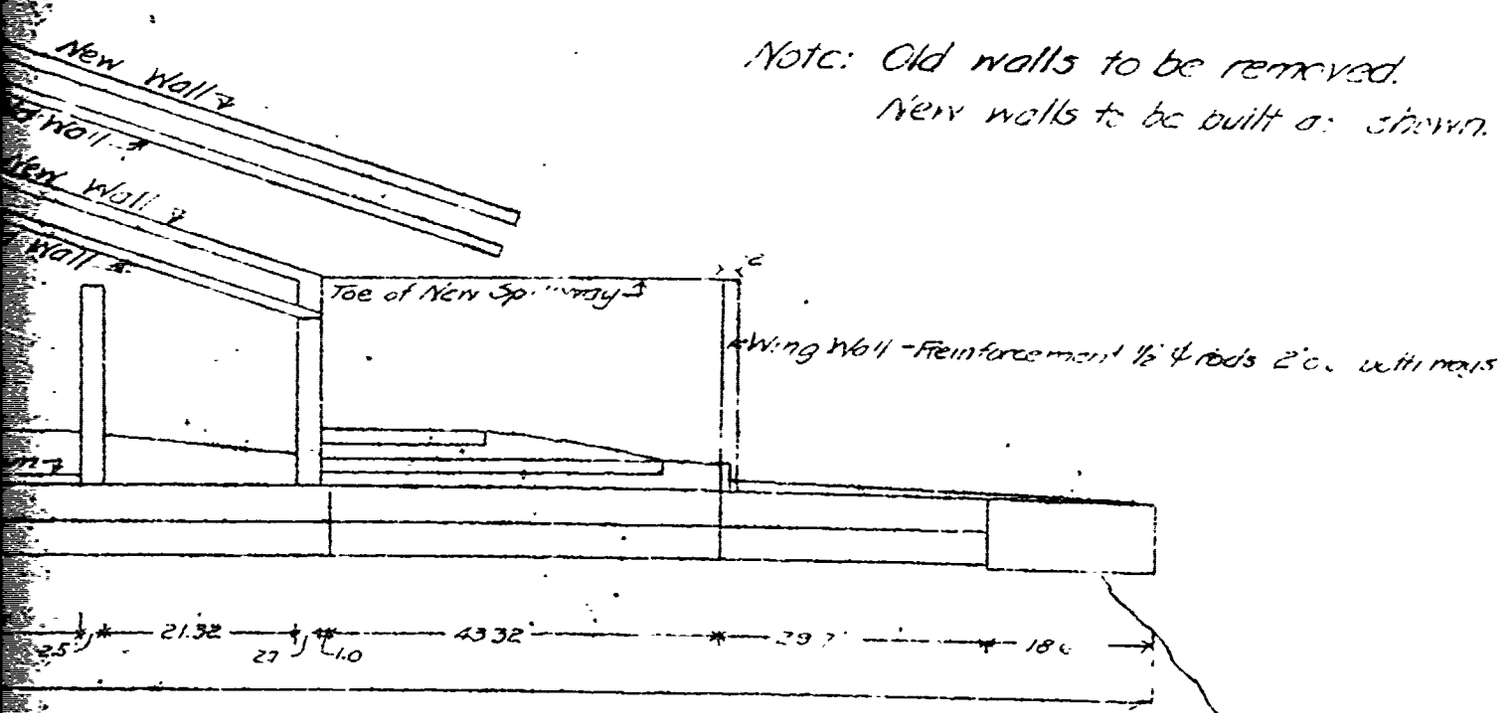
Scale 1"=20'



Section at West End of Spillway

Scale 1" = 4'

Note: Old walls to be removed.
New walls to be built as shown.

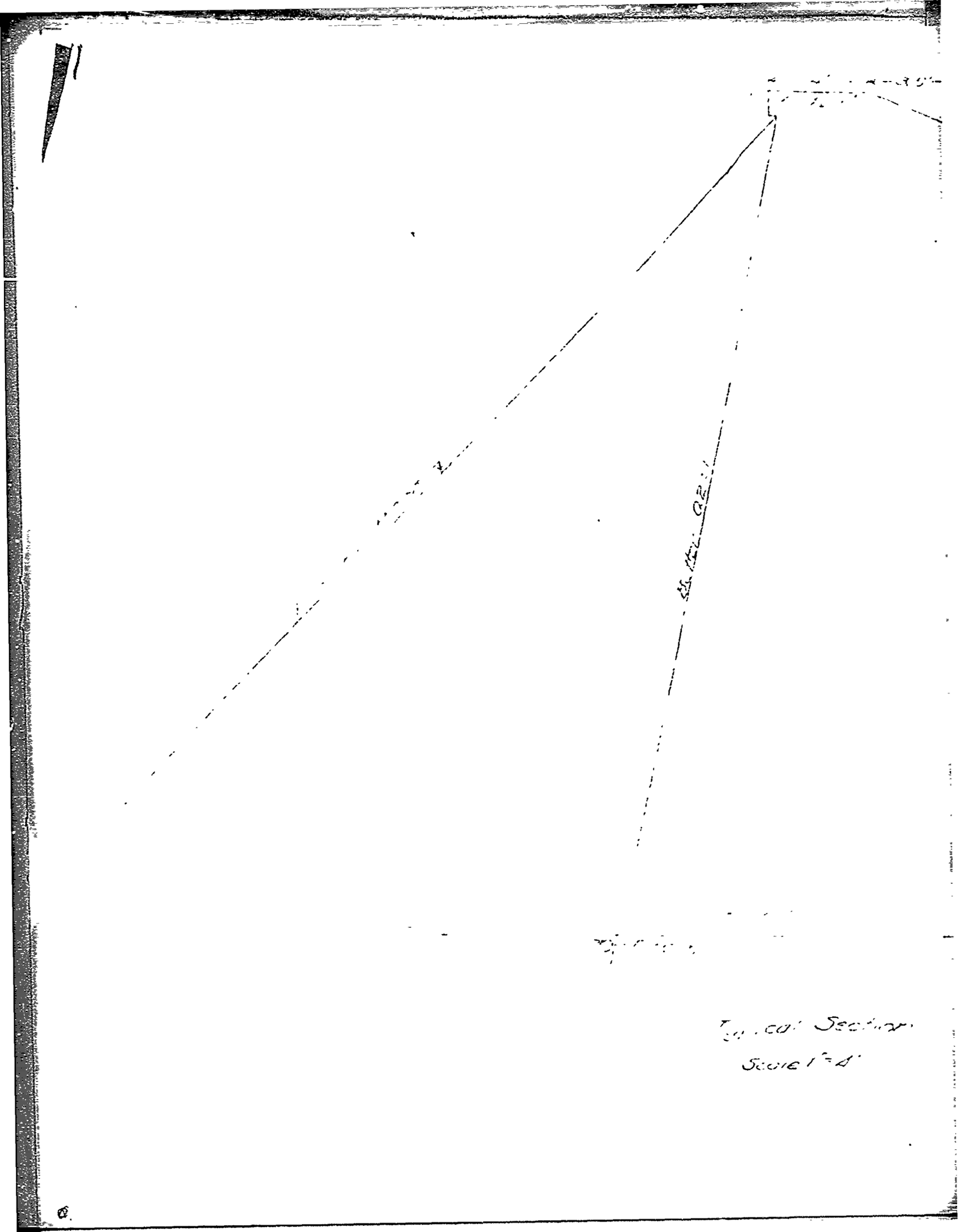


DAM AT STORAGE RESERVOIR
CITY OF BEACON
NEW YORK

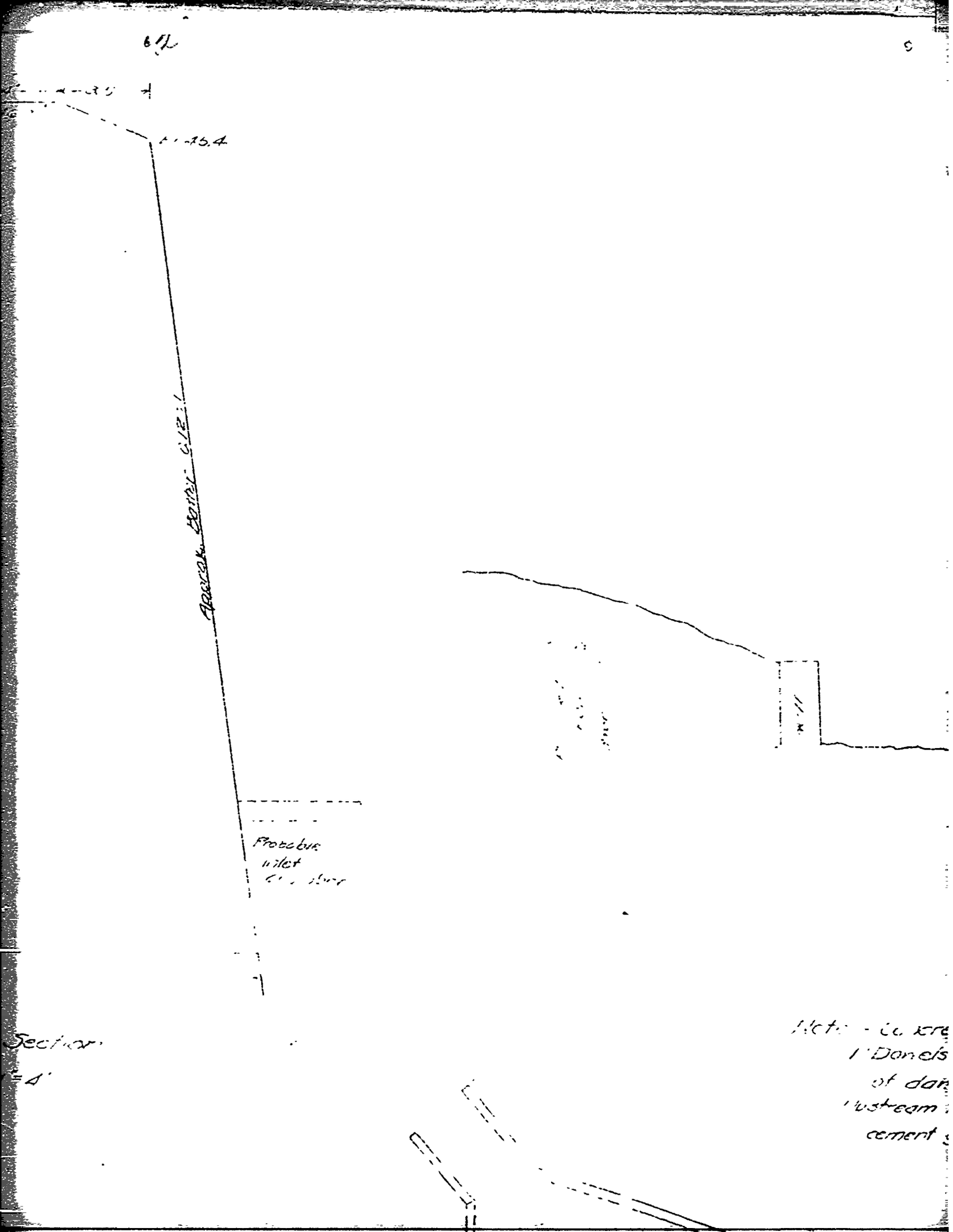
George W. Kinnear, Jr.

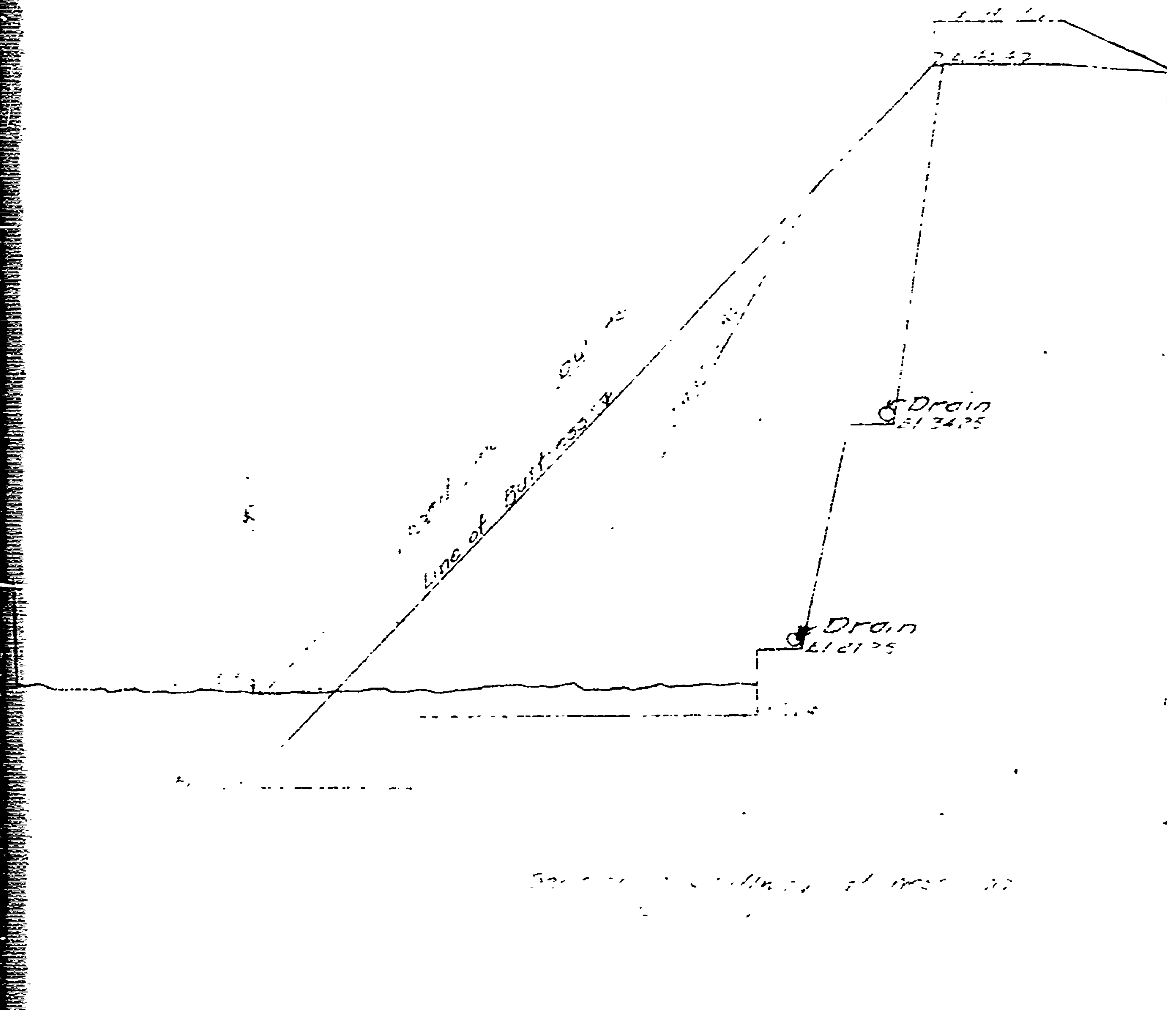
Jul, 1926

6

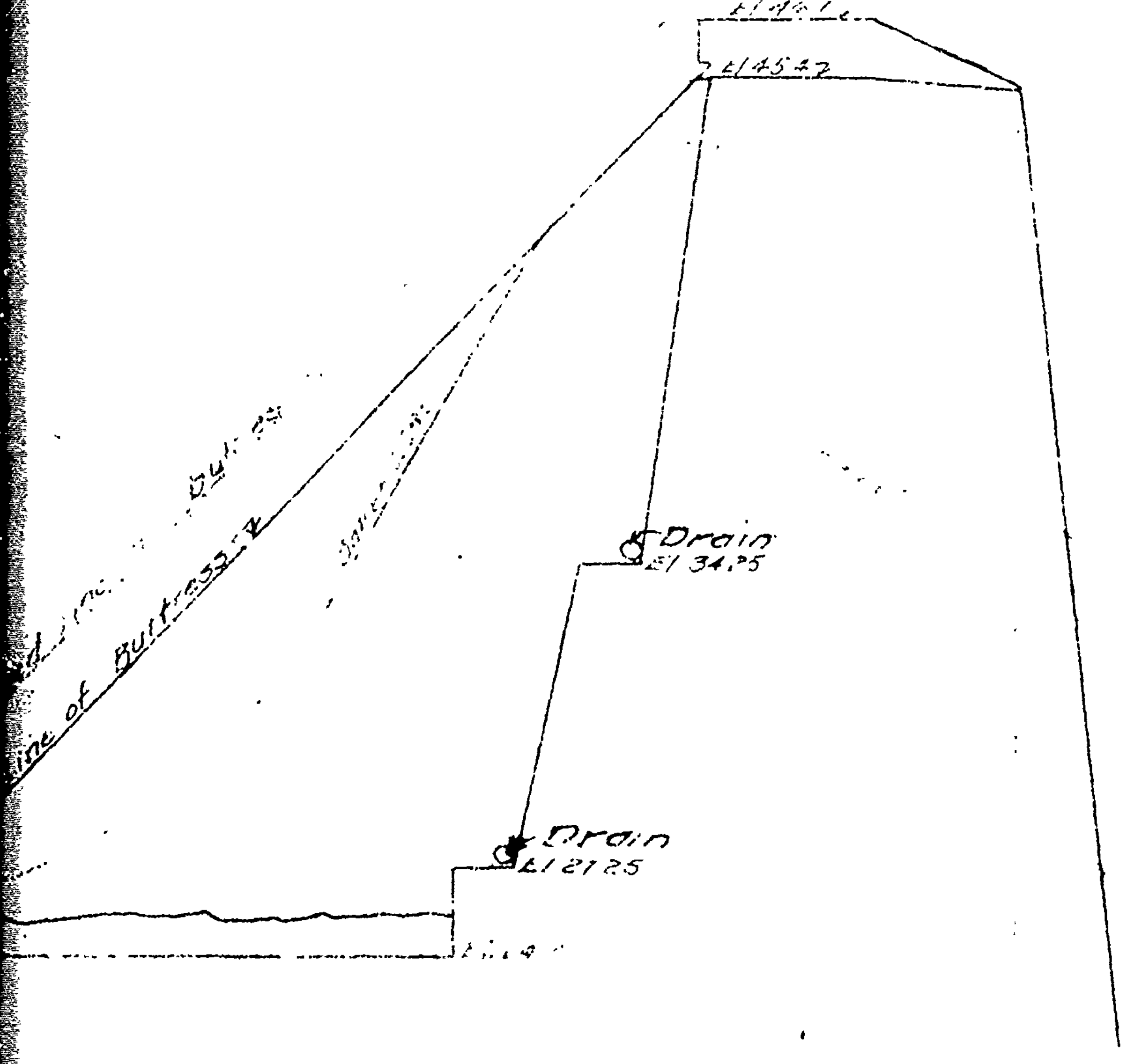


Typical Section
Scale 1"=4'


Approx. storm sewer
Protective inlet



...ote - concrete to be 1:.. 2 mi...
1" Dowels, spaced ... placed in face
of dam and in buttresses.
Upstream face of ... to be covered with 2" layer
cement gun grout ... reinforcement. —

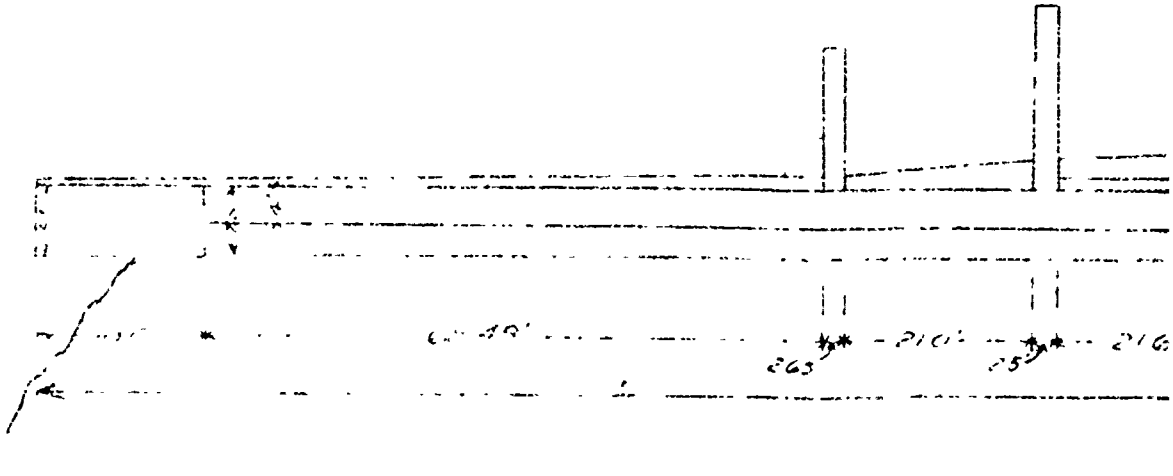


Section ... Spillway at West ...

...be placed in face
...es.
...covered with 2" layer
... reinforcement. —

Typical Section

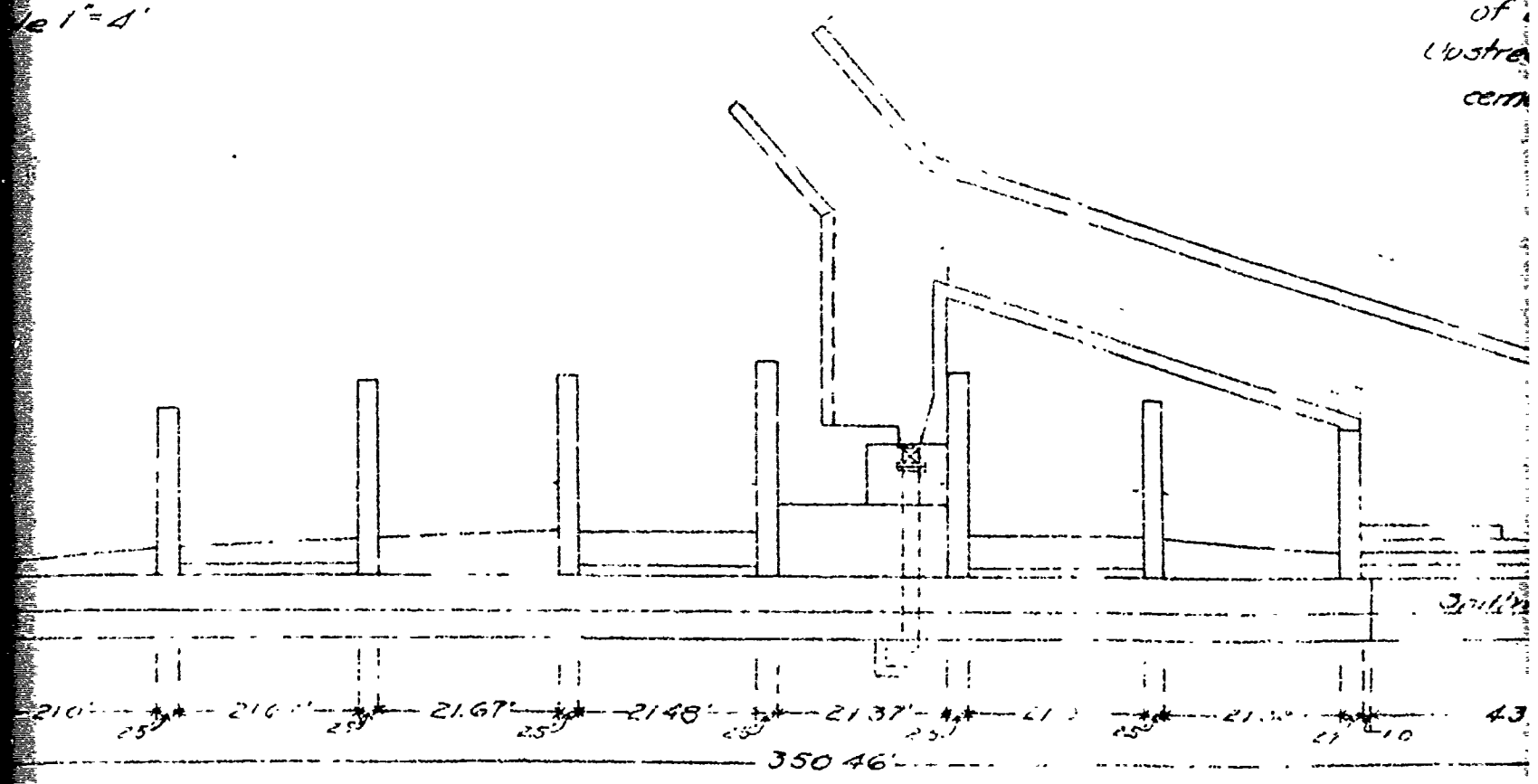
Scale 1"=4'



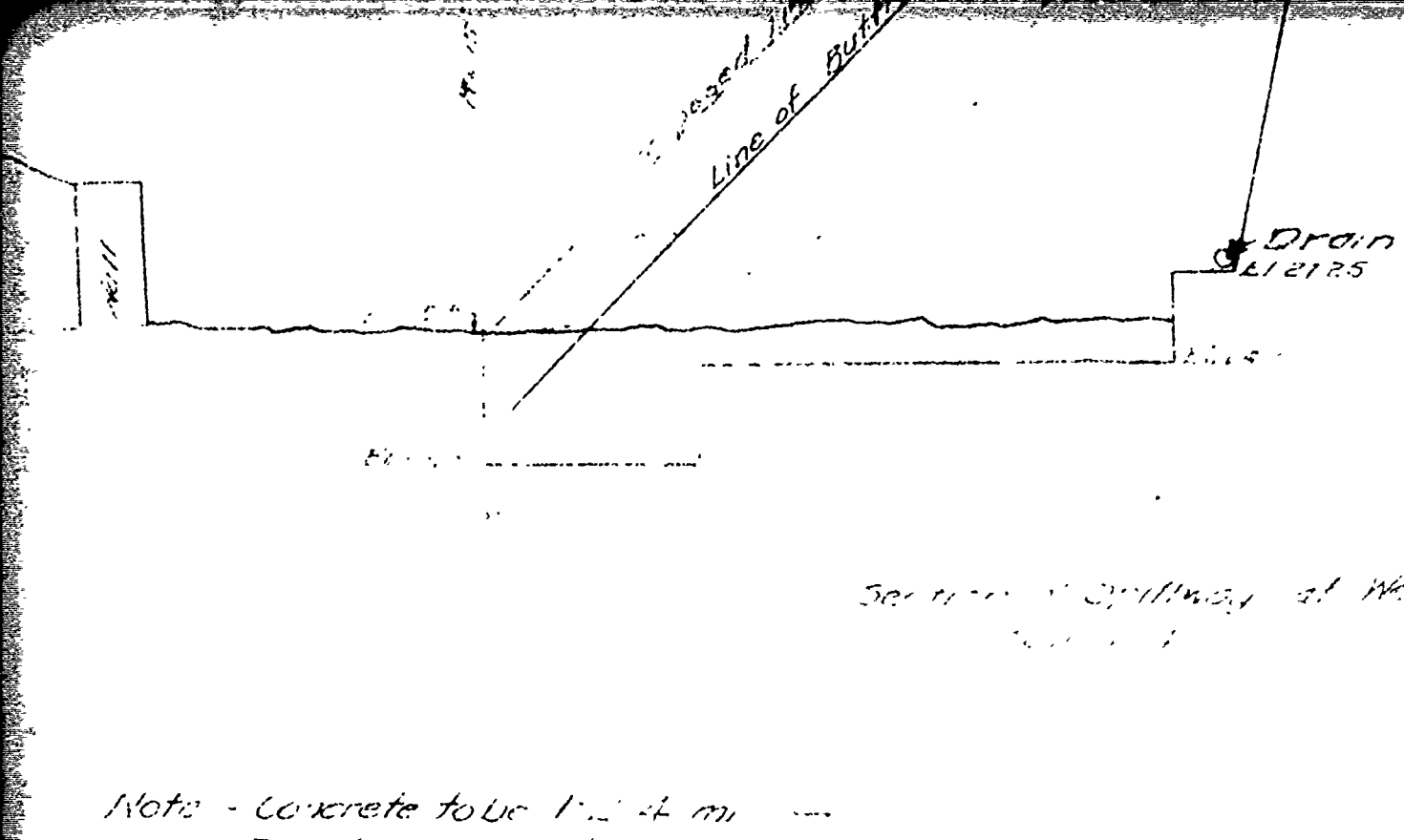
Possible
Inlet
Location

Note - Co
1" Do
of
Upstre
cem

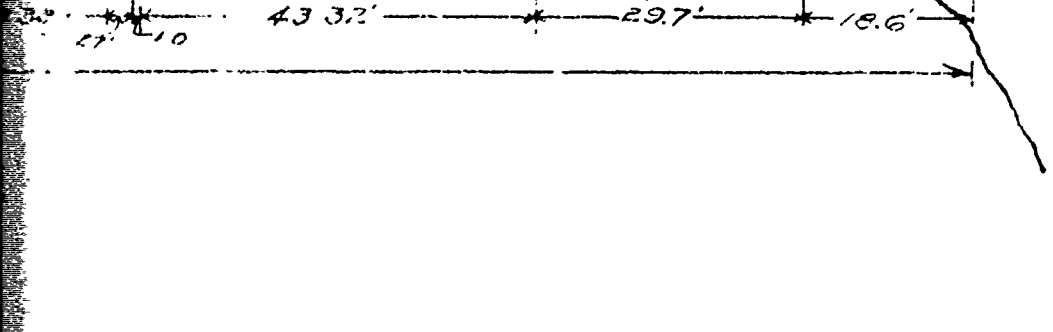
l Section
le 1"=4'



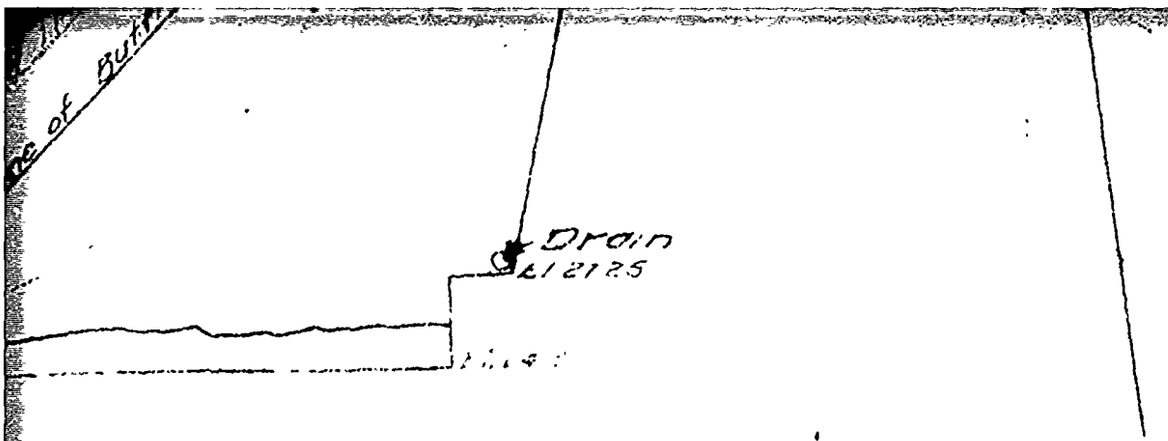
Plan
Scale 1"=20'

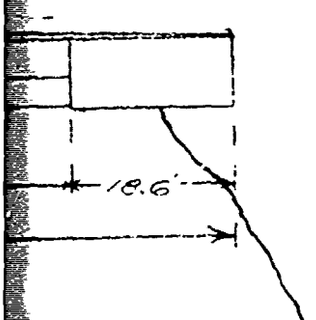


Note - Concrete to be [illegible]
1" Dowels, spaced [illegible] to be placed in face of dam and in cutoffs.
Upstream face of dam to be covered with 2" layer cement gun grout on mesh reinforcement. —



DAM AT
CITY
N
J
Ge





DAM AT STORAGE RESERVOIR

CITY OF BEACON

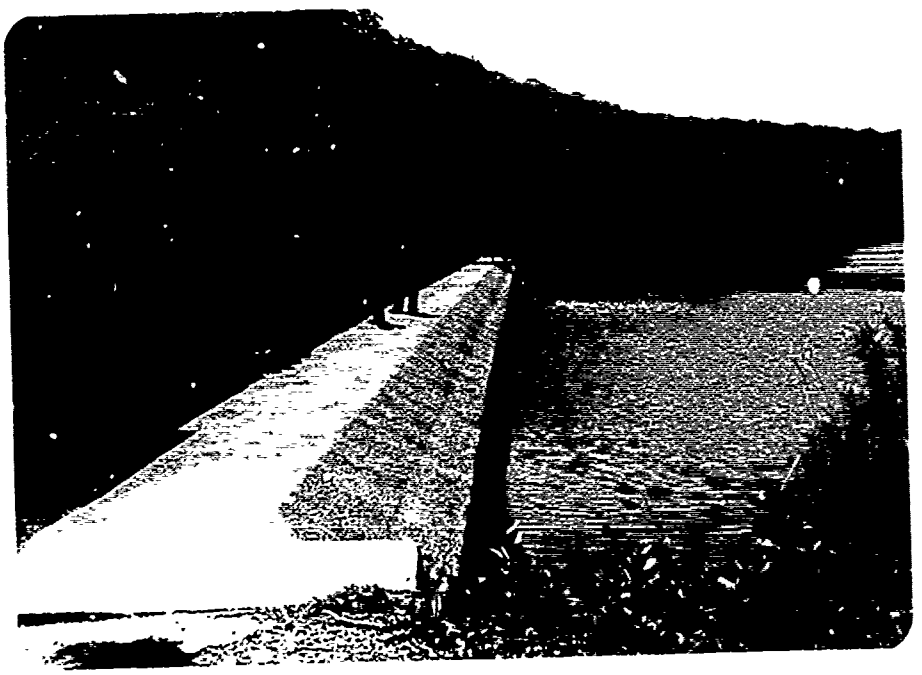
NEW YORK

July 1922

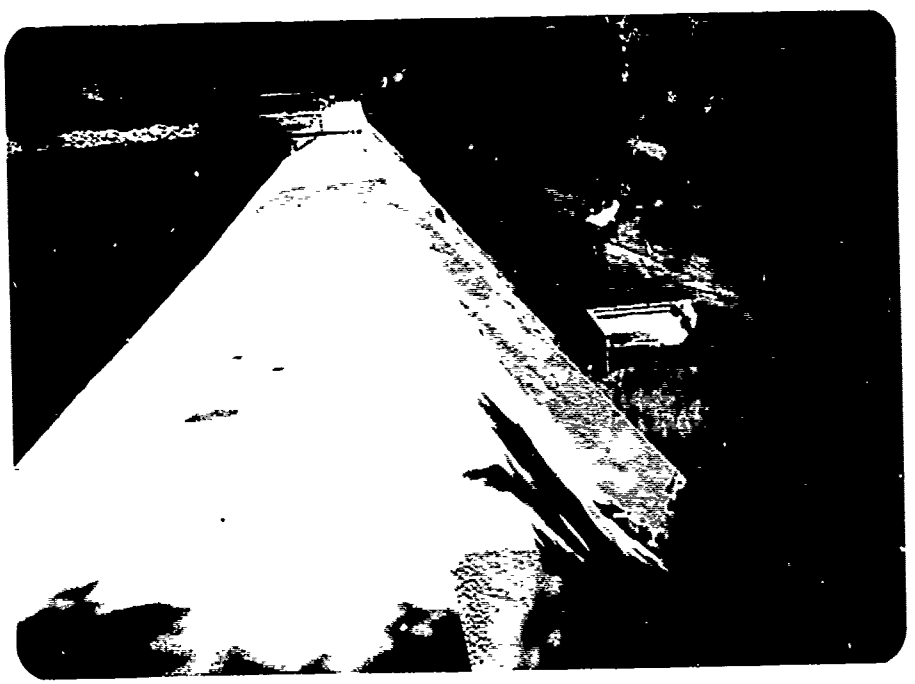
George W. Krieger, Jr.

PHOTOGRAPHS

APPENDIX B

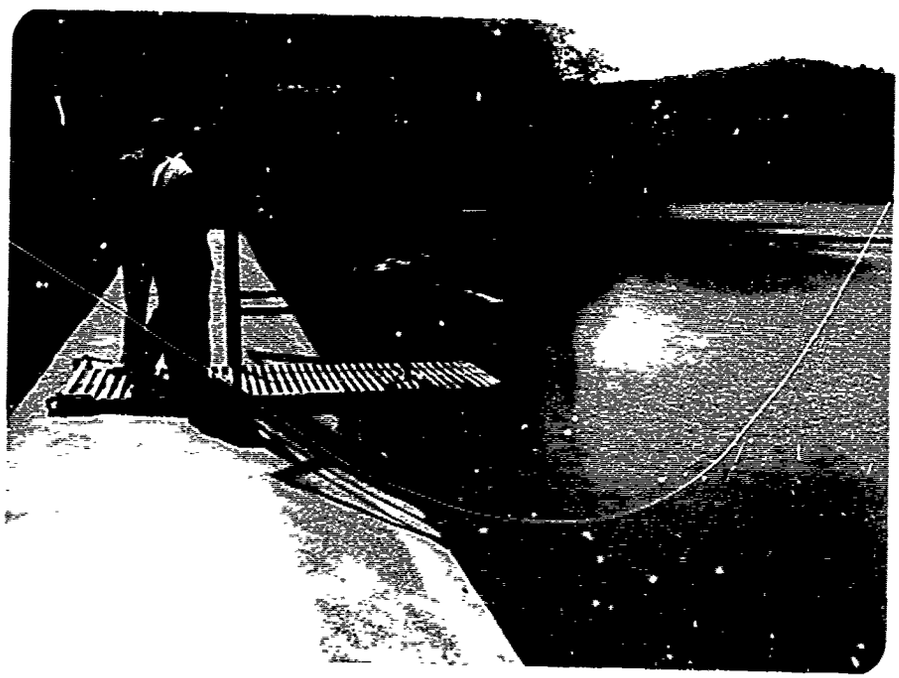


2. UPSTREAM VIEW OF DAM



3. VIEW OF SPILLWAY AND DOWNSTREAM OF DAM.
NOTE: VEGETATION AT TOE OF DAM.

4. VIEW OF UPSTREAM REGULATING CONTROL FOR RESERVOIR DRAIN.



5. VIEW OF AREA DOWNSTREAM OF DAM. NOTE:THE GATE HOUSE IN WHICH DOWNSTREAM REGULATING CONTROL IS LOCATED.

6. VIEW OF RESERVOIR DRAIN OUTLET. NOTE: 6-INCH DIAMETER PIPE NEXT TO DRAIN.

7. VIEW OF DOWNSTREAM CHANNEL AT JUNCTION OF SPILLWAY AND RESERVOIR DRAIN CHANNELS MEET.

8. VIEW OF DOWNSTREAM CHANNEL.

9. VIEW OF SEEPAGE DRAINS ON DOWNSTREAM FACE OF DAM.

10. VIEW AT RIGHT ABUTMENT AND SPILLWAY CONTACT. NOTE: SEEPAGE.

11. VIEW OF SEEPAGE AREA 50 FT DOWNSTREAM FROM DAM.

12. VIEW OF LEFT ABUTMENT. NOTE: THAT CONTACT IS LOWER THAN DAM CREST.

VISUAL INSPECTION CHECKLIST

APPENDIX C

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Mt. Beacon Reservoir.

Fed. I.D. # N.Y. 26 DEC Dam No. 557

River Basin Hudson

Location: Town Beacon County Dutchess

Stream Name Dry Brook

Tributary of Hudson River

Latitude (N) 41° 29' Longitude (W) 73° 56'

Type of Dam Concrete faced stone masonry gravity and concrete buttress D/S

Hazard Category High

Date(s) of Inspection 7-24-80

Weather Conditions Sunny ; 82°F

Reservoir Level at Time of Inspection

b. Inspection Personnel Harvey Feldman & Jyotindra H Patel

c. Persons Contacted (Including Address & Phone No.)

Mr. Mark Giordano, Supt. of Water Dept.

427 Main St.

Beacon N.Y. 12508

Tel. 914-831-0782

d. History:

Date Constructed 1889-1892 * Date(s) Reconstructed 1904, 1922, and 1974

Designer Unknown

Constructed By Unknown

Owner City of Beacon

* Based on application of specifications or reconstruction dated 10/10/1913.

2) Embankment NONE

a. Characteristics

(1) Embankment Material _____

_____

(2) Cutoff Type _____

_____

(3) Impervious Core _____

_____

(4) Internal Drainage System _____

_____

(5) Miscellaneous _____

_____

b. Crest

(1) Vertical Alignment _____

_____

(2) Horizontal Alignment _____

_____

(3) Surface Cracks _____

_____

(4) Miscellaneous _____

_____

c. Upstream Slope

(1) Slope (Estimate) (V:H) _____

(2) Undesirable Growth or Debris, Animal Burrows _____

_____

(3) Sloughing, Subsidence or Depressions _____

_____

_____

(4) Slope Protection _____

_____

_____

(5) Surface Cracks or Movement at Toe _____

_____

d. Downstream Slope

(1) Slope (Estimate - V:H) _____

(2) Undesirable Growth or Debris, Animal Burrows _____

_____

(3) Sloughing, Subsidence or Depressions _____

_____

_____

(4) Surface Cracks or Movement at Toe _____

_____

(5) Seepage _____

_____

_____

(6) External Drainage System (Ditches, Trenches; Blanket) _____

_____

_____

(7) Condition Around Outlet Structure _____

_____

(8) Seepage Beyond Toe _____

_____

e. Abutments - Embankment Contact

_____

_____

(1) Erosion at Contact _____

(2) Seepage Along Contact _____

3) Drainage System

a. Description of System From available drawings, two - 4" dia drains were installed at the downstream face of the original dam during the 1922 rehabilitation of the dam.

b. Condition of System The drains are within the dam, therefore could not be ascertained.

c. Discharge from Drainage System All the drains outlets at the downstream face were active.

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)

NONE Except a V notch weir installed in the downstream channel about 25 feet from the Reservoir Drain Outlet. Weir measures the flow from the drain and the Spillway

5) Reservoir

a. Slopes Within vicinity of the dam, reservoir slopes are stable, and no incidence of adverse conditions reported.

b. Sedimentation No evidence of excessive sedimentation observed; lake water relatively clear; and no floating debris.

c. Unusual Conditions Which Affect Dam None observed.

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) Several homes within treatment plant and storage tank (water supply) located about feet from dam.

b. Seepage, Unusual Growth About 150 feet downstream from the crest of the dam and in line with the first buttress from the left abutment there is a spongy area where seepage is observed. Vegetation along the downstream toe of dam

c. Evidence of Movement Beyond Toe of Dam None observed.

d. Condition of Downstream Channel** good except overgrown trees on the banks and minor debris at the floor of the channel.

7) Spillway(s) (Including Discharge Conveyance Channel)

Spillway is about 93 feet in length; the spillway channel is about 15 feet wide, which forms reservoir drain channel (see drawings in appendix).

a. General Spillway is broad crested; ungated and was rehabilitated several times; Downstream face is sloping. Entire spillway surface is "gunite"

b. Condition of Service Spillway Good condition; there are several hairline to 1/8" wide transverse and longitudinal cracks at the crest and downstream face of the spillway. At several locations at the downstream face there is minor seepage. At crest, near the right side of the spillway, a small cavity about 6" square gunite is missing.

c. Condition of Auxiliary Spillway NONE

d. Condition of Discharge Conveyance Channel Good except minor vegetation and debris in the floor of the channel and overgrown trees at the sides of the channel

3) Reservoir Drain/Outlet

Type: Pipe ✓ Conduit _____ Other _____

Material: Concrete _____ Metal ✓ Other _____

Size: 20 INCH (I.D)** Length 30Ft ± **

Invert Elevations: Entrance _____ Exit 1217A**

Physical Condition (Describe): Unobservable ✓

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: Gate (2) Valve _____ Uncontrolled _____

Operation: Operable ✓ Inoperable _____ Other _____

Present Condition (Describe): There are two gate valves located at upstream and downstream of the dam. Both gate valves were operated and generally in good condition. The operating stem of the downstream gate is rusted; however does not effect the operation.

** For available drawing. There are no other data on the drawing, in records of the owner.

9) Structural — The entire dam is rehabilitated by applying a gunite surfacing.

a. Concrete Surfaces — None Visible. The gunite at downstream face of the dam and buttresses appeared in relatively good conditions except at several locations there are hairline to 1/8" wide minor cracks some of which are covered with lime deposits. At the crest there also minor cracks.

b. Structural Cracking — Except as noted above there were not other structural cracking Visible

c. Movement - Horizontal & Vertical Alignment (Settlement) — There is no change in either the horizontal or vertical alignment.

d. Junctions with Abutments or Embankments — The junction between the dam and the left abutment is in good condition except there is depression behind is about 2 inches lower than the crest of the dam. The junction between the right abutment and the dam (Spillway portion) is good except there is minor seepage occurring at the contact. The seepage is about 1 Gpm.

e. Drains - Foundation, Joint, Face — There are drain outlets at several locations along the downstream face of the dam. All drains were flowing

f. Water Passages, Conduits, Sluices — 20" Reservoir drain; not accessible.

g. Seepage or Leakage — At several locations at downstream face of the dam, there are seepages through the gunite particullary at the lift joints. The other seepage through weap hole and at the right abutment contact are described above in e and d respectively.

h. Joints - Construction, etc. Entire surface is Gunite reinforce no joints observed; except gunite lift joints.

i. Foundation According to available information, the dam is on Rock.

j. Abutments Abutments are good conditions except minor seepage occuring at right abutment contact.

k. Control Gates No structural control gates.

l. Approach & Outlet Channels No approach channel; the outlet channels for reservoir drain and spillway are in good conditions. The concrete walls of the reservoir drain channel are heavily spalled. The concrete walls of the spillway channel are spalled at several locations.

m. Energy Dissipators (Plunge Pool, etc.) None

n. Intake Structures None

o. Stability Visual observations do not indicate any Stability problems.

p. Miscellaneous

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX D

TAMS

Job No. 1551-
Project MT BEACON RESERVOIR DAM INSPECTION
Subject HYDROLOGIC / HYDRAULIC COMPUTATIONS

Sheet 1 of 5
Date AUG 4 1980
By DLC
Ch'k. by

200 SQ MILE 24 HOUR PMP = 22"

% of INDEX RAINFALL. (for 10 SQ MILE)

			INCR RAIN
6 HR	111%	24.42	24.42
12 HR	121%	26.62	2.20
24 HR	133%	29.26	2.64

Redistributed rainfall.

LAKE AREA — 20 ACRE
LAND AREA — 139 ACRE

0-6	2.2
6-12	24 42
12-24	2 64

TIME		Losses	LAND R/O	LAKE R/O	TOTAL R/O
0-1	0.2	0.2	-	4.	4
2	0.3	.1	27.8	6	33.8
3	0 3	.1	27.8	6	33.8
4	0.4	.1	41.7	8	49.7
5	0.5	.1	55.6	10	65.6
6	0 5	.1	55.6	10	65.6
6-7	2 42	.1	335.	48.4	383.
8	2.94	.1	407.	58.8	466.
9	3.66	.1	507.	73.2	580.
10	9.28	.1	1290.	186.	1480.
11	3 43	.1	475.	68.6	544.
12	2.69	.1	373.	53.8	427.
12-13	.60	.1	82.	12.	94.
14	3	.1	27.8	6	33.8
15	.3	.1	27.8	6	33.8
16	.3	.1	27.8	6	33.8
17	.3	.1	27.8	6	33.8
18	.3	.1	27.8	6	33 8
19	.1	.1	0	2	2
20	.1	.1	0	2	2
21	.1	.1	0	2	2
22	.1	.1	0	2	2
23	.1	.1	0	2	2
24	.04	.04	0	0.8	0.8

TAMS

Job No. 1551-05 Sheet 2 of 5

Project MT BEACON RESERVOIR Date AUG 4, 80

Subject HYDROLOGIC / HYDRAULIC COMPUTATIONS. By D.L.C

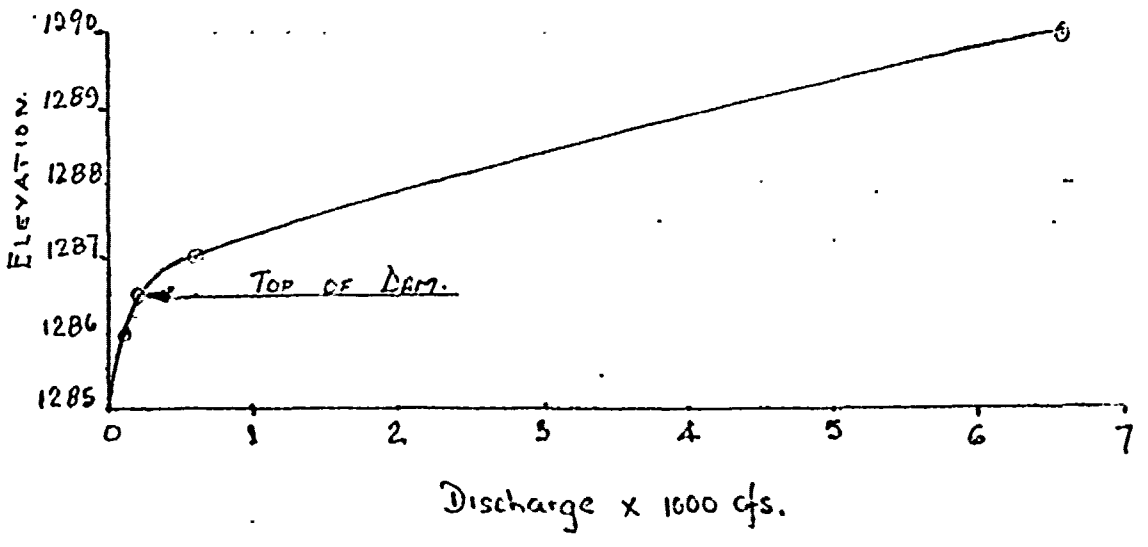
SPILLWAY RATING Ch'k. by

$Q = C L H^{3/2}$ USE $C = 2.63$. $L = 43.32'$

EL.	H	Q_s		Q_D ($L = 307'$)	Q_T
1285	0				0
1286	1	110			110
1286.5	1.5	210		0	210
1287	2	320	0.5	280	600
1290	5	1270	3.5	5290	6560
1300	15	6620	13.5	40050	46670.

Q_D ~ flow over dam.

Q_T total discharge.



TAMS

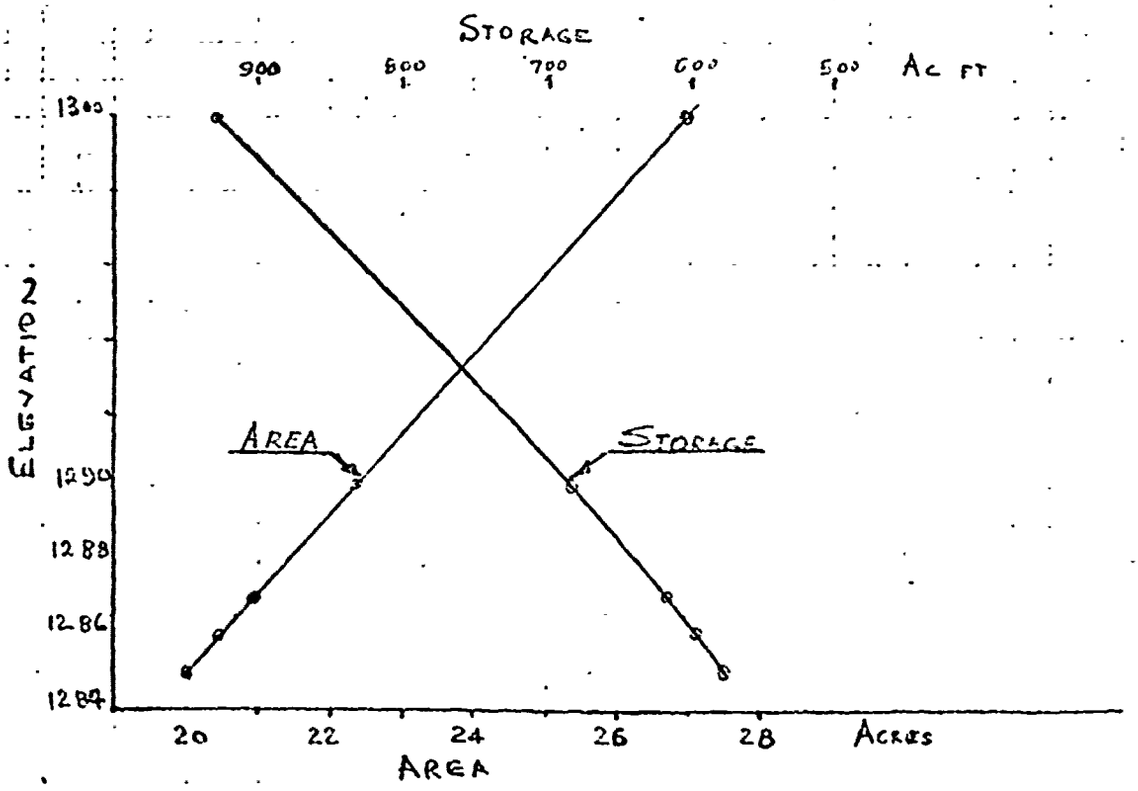
Job No. 1551-65 Sheet 3 of 5

Project MT BEACON RESERVOIR Date AUG 4 1980

Subject HYDROLOGIC / HYDRAULIC COMPUTATIONS By D.L.C

ELEVATION / AREA / VOLUME Ch'k. by

EL.	Δ H	AREA.	Mean Area	Δ Vol	STORAGE (AC FT)
1285		20			575.
	1.0		20.25	20.25	
1286		20.5			595.
	0.5		20.6	10.3	
1286.5		20.7			606.
	0.5		20.8	10.4	
1287		20.9			616.
	3.0		21.6	64.8	
1290		22.3			681.
	10.0		24.65	246.5	
1300		27			927.



1705
1965

TAMS

Job No. 1551-05 Sheet 4 of 5

Project Mt - Beacon Reservoir Date Aug 4 1992

Subject Valley cross sections By QP

Ch'k. by

STATION - 350

DISTANCE	ELEVATION
1800	1300
1820	1280
1850	1260
1900	1240
2000	1238
2070	1240
2100	1260
2150	1280
2190	1300

STATION - 4400

DISTANCE	ELEVATION
1850	1520
1880	500
1910	480
1950	460
2000	440
2090	460
2170	480
2210	500
2290	520

TAMS

Job No. 1551-02 Sheet 5 of 5

Project Mt Eaton Reservoir Date Aug. '80

Subject Valley cross section. By G.F.

Ch'k. by

STATION. 2200.

DISTANCE	ELEVATION.
1810	820
1850	800
1870	780
1920	760
2000	740
2100	760
2150	780
2200	800
2250	820

Aug. 4, 1980

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
  1        A1                         MT GEASON RESERVOIR                    1551-05
  2        A2                         PHASE 1 INSPECTION AUG 1980
  3        A3                         PROBABLE MAXIMUM FLOOD ANALYSIS
  4        B      24       1      0.       0       0       0       0       0       0       0
  5        B1      5
  6        J       1       2       1
  7        J1      1     0.3
  8        K       0       1
  9        K1           INFLOW HYDROGRAPH.
 10        M      -1            0.25
 11        N       4    33.6    33.5    49.7    65.6    65.6     383     466     580    1430
 12        N     544     427      94    33.8    33.8    33.8    33.8    33.3       2       2
 13        N       2       2       2     0.8
 14        K       1       2
 15        K1           RESERVOIR ROUTING
 16        Y                               1       1
 17        Y1      1                                       575.            -1
 18        Y4   1285    1286  1286.5    1287    1290    1300
 19        Y5      0     110     210     600    6560   46670
 20        $A    575     575     606     616     631     927
 21        $E   1235    1286  1286.5    1287    1290    1300
 22        $$   1215
 23        $D1286.5
 24        K       1       3
 25        K1           CHANNEL ROUTING      STATION 350
 26        Y                               1       1
 27        Y1      1
 28        Y6   0.03    0.03    0.03    1238    1300     350   0.079
 29        Y7 [illegible]  1300    1270    1250    1350    1760    1900    1240    2000    1238
 30        Y7   2570    1240    2100    1260    2150    1780    2190    1300
 31        K       1       4
 32        K1           CHANNEL ROUTING      STATION 2270
 33        Y                               1       1
 34        Y1      1
 35        Y6   0.03    0.03    0.03     740     800    1030   0.249
 36        Y7   1110     820    1830     800    1200     740    1220     760    2000     740
 37        Y7 [illegible]   760    2130     780    2200     800    2750     820
 38        K       1       5
 39        K1           CHANNEL ROUTING      STATION 4400
 40        Y                               1       1
 41        Y1      1
 42        Y6   0.03    0.03    0.03     440     570    7200   0.136
 43        Y7 [illegible]   580    1250     500    1710     480    1950     460    2000     440
 44        Y7 [illegible]   460    2170     480    2210     500    2250     520
 45        K      99
```

(2)

```
**********
HEC1 HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION  24 FEB 79
**********

RUN DATE= 80/08/05.
TIME= 15.46.46.
```

MT BEACON RESERVOIR
PHASE 1 INSPECTION AUG 1980 1551-05
PROBABLE MAXIMUM FLOOD ANALYSIS

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
24	1	.0	0	0	0	0	0	0	0

IOPES	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS= 1.00 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	7	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	.25	0.00	.25	0.00	0.000	0	0	0

INPUT HYDROGRAPH

4.	34.	34.	50.	66.	66.	383.	466.	580.	1480.		
544.	427.	91.	34.	34.	34.	34.	34.	2.	2.		
2.	2.	2.	1.								

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1480.	620.	167.	105.	4404.
CMS	42.	18.	5.	3.	125.
INCHES		23.37	27.31	27.31	27.31
MM		582.41	693.70	693.70	693.70
AC-FT		308.	344.	764.	764.
THOUS CU M		381.	442.	942.	942.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

4.	34.	34.	50.	66.	66.	383.	466.	580.	1480.		
544.	427.	91.	34.	34.	34.	34.	34.	2.	2.		
2.	2.	2.	1.								

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1489.	623.	183.	183.	4404.
CMS	42.	18.	5.	5.	125.
INCHES		23.17	27.31	27.31	27.31
MM		588.47	693.70	693.70	693.70
AC-FT		309.	364.	364.	364.
THOUS CU M		381.	449.	449.	449.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

2.	17.	17.	23.	33.	33.	192.	233.	290.	740.
272.	214.	47.	17.	17.	17.	17.	17.	1.	1.
1.	1.	1.	0.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	740.	371.	92.	92.	2206.
CMS	21.	9.	3.	3.	62.
INCHES		11.53	13.56	13.56	13.56
MM		294.21	344.25	344.25	344.25
AC-FT		154.	182.	182.	182.
THOUS CU M		190.	224.	224.	224.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	575.	-1

STAGE	1235.00	1284.00	1286.50	1287.00	1290.00	1300.00
FLOW	0.00	110.00	210.00	600.00	6560.00	41670.00
CAPACITY=	575.	595.	606.	616.	681.	927.
ELEVATION=	1235.	1286.	1287.	1287.	1290.	1300.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1235.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1286.5	0.0	0.0	0.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	8.	15.	26.	33.	48.	115.	377.	557.	1283.
947.	346.	249.	177.	77.	67.	55.	47.	36.	24.
[illegible]	[illegible]	[illegible]	[illegible]						

STORAGE

576.	576.	576.	576.	582.	584.	596.	610.	615.	624.
599.	600.	597.	597.	591.	587.	585.	584.	582.	579.
578.	577.	576.	576.						

STAGE

1284.0	1285.1	1285.2	1285.2	1285.3	1285.4	1286.0	1286.7	1286.9	1287.3
1284.9	1284.7	1285.5	1286.1	1285.8	1285.6	1285.5	1285.4	1285.3	1285.2
1285.1	1285.1	1285.1	1285.0						

PEAK OUTFLOW IS 1287. AT TIME 19.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1293.	609.	183.	183.	4396.
CMS	37.	17.	5.	5.	124.
INCHES		22.59	27.26	27.26	27.26
HM		567.74	692.45	692.45	692.45
AC-FT		299.	363.	363.	363.
THOUS CU M		367.	448.	448.	448.

STATION 2, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	4.	9.	13.	19.	24.	37.	116.	196.	572.
491.	197.	141.	97.	67.	49.	27.	30.	22.	14.
8.	6.	4.	3.						

STORAGE

577.	576.	577.	577.	578.	579.	585.	596.	604.	615.
599.	595.	601.	592.	587.	584.	582.	580.	579.	578.
577.	576.	576.	574.						

STAGE

1285.2	1285.2	1285.4	1285.4	1285.5	1285.5	1285.9	1286.7	1286.4	1287.0
1285.4	1285.3	1285.2	1285.1	1285.4	1285.3	1285.2	1285.2	1285.2	1285.1
1285.1	1285.1	1285.1	1285.0						

PEAK OUTFLOW IS 572. AT TIME 19.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	572.	287.	92.	92.	2197.
CMS	16.	8.	3.	3.	62.
INCHES		10.70.	13.63	13.63	13.63
HM		271.78	344.11	346.11	344.11
AC-FT		143.	182.	182.	182.
THOUS CU M		176.	224.	224.	224.

********** *********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING STATION 35:

ISTAO	ICOMP	ICOCN	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO

(5)

				ROUTING DATA					
QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP			LSTR
0.0	0.000	0.00	1	1	0	0			0
	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT	
	1	0	0	0.000	0.000	0.000	0.	0	

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0[illegible]	.0[illegible]	.0300	1238.0	1300.0	350.	.07900

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
[illegible] 1250.00 1850.00 1260.00 1900.00 1240.00 2000.00 1238.00
2 [illegible] 1240.00 2100.00 1260.00 2150.00 1280.00

STORAGE	0.00	3.12	7.32	12.99	18.43	24.21	30.34	36.72	43.63	[illegible]
	[illegible]	65.13	74.31	83.83	91.34	100.33	109.21	118.47	127.22	[illegible]
OUTFLOW	0.00	9204.81	41259.13	90456.05	135725.30	275743.07	370784.30	442027.13	576497.78	727512.13
	[illegible]	1073764.10	1291620.12	1501840.20	1746469.12	2007692.93	2285137.20	2578489.39	2887473.50	[illegible]
STAGE	1238.00	1241.26	1244.53	1247.79	1251.05	1254.32	1257.58	1260.84	1264.11	1267.37
	1270.63	1273.89	1277.16	1280.42	1283.68	1286.95	1290.21	1293.47	1296.74	1300.00
FLOW	0.00	9224.51	41259.13	90454.05	155725.30	275742.07	370326.30	442027.13	576497.87	727510.13
	[illegible]	1079264.13	1251678.12	1501840.22	1746469.12	2007497.98	2285137.29	2578409.39	2887482.52	[illegible]

STATION 3, PLAN 1, RTIO 1

OUTFLOW

3.	4.	19.	23.	39.	47.	116.	373.	559.	1226.
107.	339.	243.	121.	94.	61.	61.	41.	42.	18.
27.	3.	13.	0.						

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.						

STAGE

1238.0	1238.0	1238.0	1239.0	1239.0	1238.0	1238.0	1238.1	1238.2	1238.3
1238.3	1239.1	1239.1	1239.0	1238.0	1238.0	1238.0	1238.0	1238.0	1238.0
1238.0	1238.0	1238.0	1238.0						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1226.	620.	183.	183.	4394.
CMS	36.	17.	5.	5.	124.
INCHES		22.39	27.26	27.26	27.26
MM		564.96	692.48	692.48	692.48
AC-FT		297.	363.	363.	363.
THOUS CU M		367.	448.	448.	448.

MAXIMUM STORAGE = 0.

MAXIMUM STAGE IS 1239.0

(6)

STATION 3, PLAN 1, RTIO 2

OUTFLOW

[illegible]	[illegible]	[illegible]	13.	20.	23.	37.	115.	196.	565.
495.	197.	167.	96.	69.	47.	38.	28.	23.	13.
11.	5.	3.	2.						

STOP

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.						

STAGE

1235.0	1238.0	1238.0	1238.0	1238.0	1238.0	1238.0	1238.0	1238.1	1238.2
1238.2	1238.1	1238.1	1238.0	1238.0	1238.0	1238.0	1238.0	1238.0	1238.0
1238.0	1238.0	1238.0	1238.0						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	560.	787.	92.	92.	2197.
CMS	16.	8.	3.	3.	62.
INCHES		10.70	13.63	13.63	13.63
MM		271.69	346.11	346.11	346.11
AC-FT		143.	182.	182.	182.
THOUS CU M		176.	224.	224.	224.

MAXIMUM STORAGE = 0.

MAXIMUM STAGE IS 1238.2

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING STATION 2200

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0350	.0350	.0300	740.0	780.0	1950.	.26900

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
[illegible] 1980.00 760.00 2000.00 740.00
[illegible]

```
 STORAGE        0.00        3.39       13.55       30.49      134.71       54.52      119.03      156.49      196.86      240.44
              286.79      336.87      390.14      446.20      506.74      576.42      670.53      789.07      934.44     1124.22

 OUTFLOW        0.00     3321.77    21000.79    62176.80   133925.48   243620.34   421207.43   633452.93   885710.33  1173675.60
          1528308.03  1979931.61  2400297.01  2912363.86  3477450.53  4099878.74  4841837.46  5717164.40  6750537.73  7964594.03

 STAGE        740.00      744.21      748.42      752.63      756.84      761.05      765.26      769.47      773.68      777.89
              782.11      786.32      790.53      794.74      798.95      803.16      807.37      811.58      815.79      820.00

 FLOW           0.00     3321.28    21000.79    62176.80   133925.48   243620.34   421207.47   677452.03   885710.33  1173675.60
          1528308.03  1979931.61  2400297.01  2912363.86  3477450.53  4099878.74  4841837.46  5717164.40  6750537.73  7964594.03

                                 STATION      4, PLAN 1, RTIO 1

                                              OUTFLOW
        6.          4.         21.         23.         41.         45.        116.        760.        550.       1267.
      153.        325.        264.        108.        106.         50.         72.         32.         51.         10.
       24.          9.         17.          0.

                                              STOR
        0.          0.          0.          0.          0.          0.          0.          0.          1.          1.
        1.          0.          1.          0.          0.          0.          0.          0.          0.          0.
        0.          0.          0.          0.

                                              STAGE
    740.0       740.0       740.0       740.0       740.1       740.1       740.1       740.5       740.7       741.6
    740.1       740.4       740.3       740.1       740.1       740.1       740.1       740.0       740.1       740.0
    740.0       740.0       740.0       740.0

                          PEAK      6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                 CFS     1267.       600.       183.       183.          4389.
                 CMS       36.        17.         5.         5.           125.
              INCHES                22.31      27.28      27.28          27.28
                  MM               566.67     692.95     692.95         692.95
               AC-FT                 297.       364.       364.           364.
          THOUS CU M                 367.       448.       448.           448.

                                 MAXIMUM STORAGE =        1.

 MAXIMUM STAGE IS     741.6

                                 STATION      4, PLAN 1, RTIO 2

                                              OUTFLOW
        7.          2.         11.         11.         21.         22.         57.        114.        172.        560.
      224.        193.        166.         95.         73.         46.         43.         27.         24.         12.
       11.          4.          6.          1.

                                              STOR
        0.          0.          0.          0.          0.          0.          0.          0.          0.          1.
        0.          0.          0.          0.          0.          0.          0.          0.          0.          0.
        0.          0.          0.          0.

                                              STAGE
    740.0       740.0       740.0       740.0       740.0       740.0       740.1       740.1       740.2       740.7
    740.6       740.2       740.2       740.1       740.1       740.1       740.1       740.0       740.0       740.0
    740.0       740.0       740.0       740.0

                          PEAK      6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                 CFS      560.       2[illegible].        92.        92.          21[illegible].
                 CMS       16.         [illegible].          [illegible].          [illegible].            62.
              INCHES            1[illegible].70     13.4[illegible]     13.4[illegible]        13.[illegible]
                  MM            [illegible]       34[illegible]      346.[illegible]        346.[illegible]
               AC-FT                 1[illegible].      1[illegible]7.      1[illegible]7.          [illegible]
          THOUS CU M                 [illegible]        [illegible]        [illegible]            [illegible]
```

MAXIMUM STORAGE = 4.

MAXIMUM STAGE IS 740.7

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING STATION 4400

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0[illegible]	.0200	.0200	440.0	520.0	2200.	.13600

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
[illegible] 520.00 [illegible] 500.00 1910.00 430.00 1955.00 450.00 2000.00 440.00
2[illegible] 440.00 2170.00 460.00 2210.00 500.00

STORAGE	0.00	3.17	12.54	28.20	50.14	78.32	112.12	151.29	195.24	245.75
	300.76	359.19	420.74	483.44	553.26	622.72	693.57	768.77	843.31	919.19
OUTFLOW	0.00	1014.97	11524.35	32977.62	73175.03	135456.07	229062.04	347753.57	494[illegible].26	67[illegible].15
	[illegible]	1139799.10	1462039.49	1798641.48	2170037.50	2591859.21	3054690.15	3552911.66	4086[illegible].43	4654[illegible].52
STAGE	440.00	444.21	448.42	452.63	456.84	461.05	465.26	469.47	473.68	477.89
	482.11	486.32	490.53	494.74	498.95	503.16	507.37	511.33	515.79	520.00
FLOW	0.00	1014.97	11524.35	32977.62	73175.03	135456.07	229062.04	347753.57	494[illegible].26	67[illegible].15
	[illegible]	1139799.18	1462039.49	1798641.43	2170037.50	2591390.2[illegible]	3054690.15	3552911.36	4086[illegible].42	4654[illegible].32

STATION 5, PLAN 1, RTIO 1

OUTFLOW

[illegible]	0.	24.	70.	47.	43.	113.	[illegible]	351.	1230.
[illegible]	300.	251.	95.	113.	44.	76.	39.	53.	[illegible]
[illegible]	2.	13.	0.						

STOP

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STAGE

440.3	440.4	440.1	440.0	440.1	440.1	440.3	440.5	441.3	442.5
440.2	440.2	440.2	440.2	440.2	440.1	440.2	440.1	440.1	440.0
440.1	440.0	440.0	440.0						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1270.	599.	183.	183.	4480.
CMS	35.	17.	5.	5.	125.
INCHES		22.29	27.29	27.29	27.29
MM		566.13	693.07	693.07	693.07
AC-FT		277.	364.	364.	364.
THOUS CU M		366.	449.	449.	449.

MAXIMUM STORAGE = 2.

MAXIMUM STAGE IS 442.5

STATION . 5, PLAN 1, RTIO 2

OUTFLOW

4.	9.	42.	10.	21.	22.	57.	112.	104.	547.
113.	193.	145.	94.	70.	47.	39.	20.	23.	14.
10.	6.	5.	3.						

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.						

STAGE

441.3	440.3	440.2	440.2	440.2	440.1	440.1	440.3	440.4	441.3
440.2	440.2	440.1	440.2	440.2	440.1	440.1	440.1	440.1	440.0
440.1	440.0	440.0	440.0						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	347.	288.	92.	92.	2190.
CMS	10.	8.	3.	3.	62.
INCHES		10.70	13.63	13.63	13.63
MM		271.79	346.16	346.16	346.16
AC-FT		145.	182.	182.	182.
THOUS CU M		174.	224.	224.	224.

MAXIMUM STORAGE = 1.

MAXIMUM STAGE IS 441.3

********** ********** ********** ********** **********

********** ********** ********** ********** **********

FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00	RATIO 2 .50
********** AT	1	.23	1	1480.	740.
		(.60)		(41.91)	(20.95)
********** TO	2	.23	1	1293.	572.
		(.60)		(36.62)	(16.19)
********** TO	3	.23	1	1284.	568.
		(.60)		(36.41)	(16.10)
********** TO	4	.23	1	1257.	560.
		(.60)		(35.57)	(15.85)
********** TO	5	.23	1	1270.	547.
		(.60)		(35.96)	(15.49)

RATIOS APPLIED TO FLOWS

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	STORAGE	1205.00	1215.00	1224.50
	OUTFLOW	575.	575.	575.
		0.	0.	410.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1227.32	.82	624.	1002.	6.00	10.00	0.00
.50	1226.96	.46	445.	572.	2.00	10.00	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	1264.	1230.5	10.00
.50	558.	1220.2	10.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	1767.	741.4	10.00
.50	560.	740.7	10.00

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	1928.	442.5	10.00
.50	547.	441.3	10.00

STABILITY ANALYSIS

APPENDIX E

Job No. 1551-04 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK Sheet A of ___

Project DAM CITY OF BEACON Date 8-6-80

Subject STABILITY ANALYSIS OVERFLOW SECTION By HBC

INDEX Chk. by ___

SHEET No. DESCRIPTION

I ASSUMPTIONS, LOADING CONDITIONS & STABILITY CRITERIA

1) TYPICAL CROSS SECTION - D.L. MARKS

2) PLAN - BETWEEN BUTTRESSES

3) DEAD LOADS

4) HYDROSTATIC FORCES

5) CASE 1 - SUMMARY NORMAL LOADING W/O ICE
RESULTANT WITHIN MIDDLE THIRD

Max f = 1.52 K/FT^2 = 10.6 psi FFS = 2.64 > 1.5 OK

6) CASE 2 NORMAL LOADING PLUS ICE LOAD
RESULTANT WITHIN MIDDLE THIRD

Max f = 1.06 K/FT^2 = 7.4 psi FFS = 1.83 > 1.50 OK

7) CASE 5 NORMAN LOADING WITH ER = 0.05 LAKE LEVEL 1265

8) " SUMMARY LOADS RESULTANT WITHIN MIDDLE THIRD

Max f = 1.36 K/FT^2 = 9.5 psi FFS = 2.07 > 1.25

9) CASE 3 $\frac{1}{2}$ PMF

SUMMARY LOADS RESULTANT WITHIN MIDDLE THIRD

FFS = 2.04 > 1.25

10) CASE 4 PMF NOT CRITICAL, BY INSPECTION

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. 1551-04 Sheet I of
Project DAM CITY OF BEACON, N.Y. Date 8-4-80
Subject STABILITY ANALYSIS By HCL
OVERFLOW SECTION Chk. by

ASSUMPTIONS

1) THE UNIT WT OF CONCRETE ASSUMED 150 pcf
2) ICE LOAD OF 5000 psf ACTING 1 FOOT FROM TOP OF DAM (C. OF E. CRITERIA)
3) DAM SITE IS SEISMIC ZONE 2
4) ANGLE OF INTERNAL RESISTANCE OF ROCK $\phi = 45°$

LOADING CONDITION

CASE 1) NLC LAKE LEVEL @ SPILLWAY CREST EL. 1285, NO ICE LOAD

CASE 2) NLC DITTO , WITH ICE LOAD

3) UNUSUAL EXCEPT LC LAKE LEVEL @ $\frac{1}{2}$ PMF U/S 1286.96 D/S 1266.7 *

4) EXTREME LC " " @ PMF U/S 1287.35 D/S 1267.0 *

STABILITY CRITERIA:

The stability criteria against overturning and sliding were evaluated as follows.

Overturning - Stability is considered adequate if the resultant of all forces falls within the middle third of the base under the normal loading condition and within middle half of the base under the unusual and extreme loading conditions.

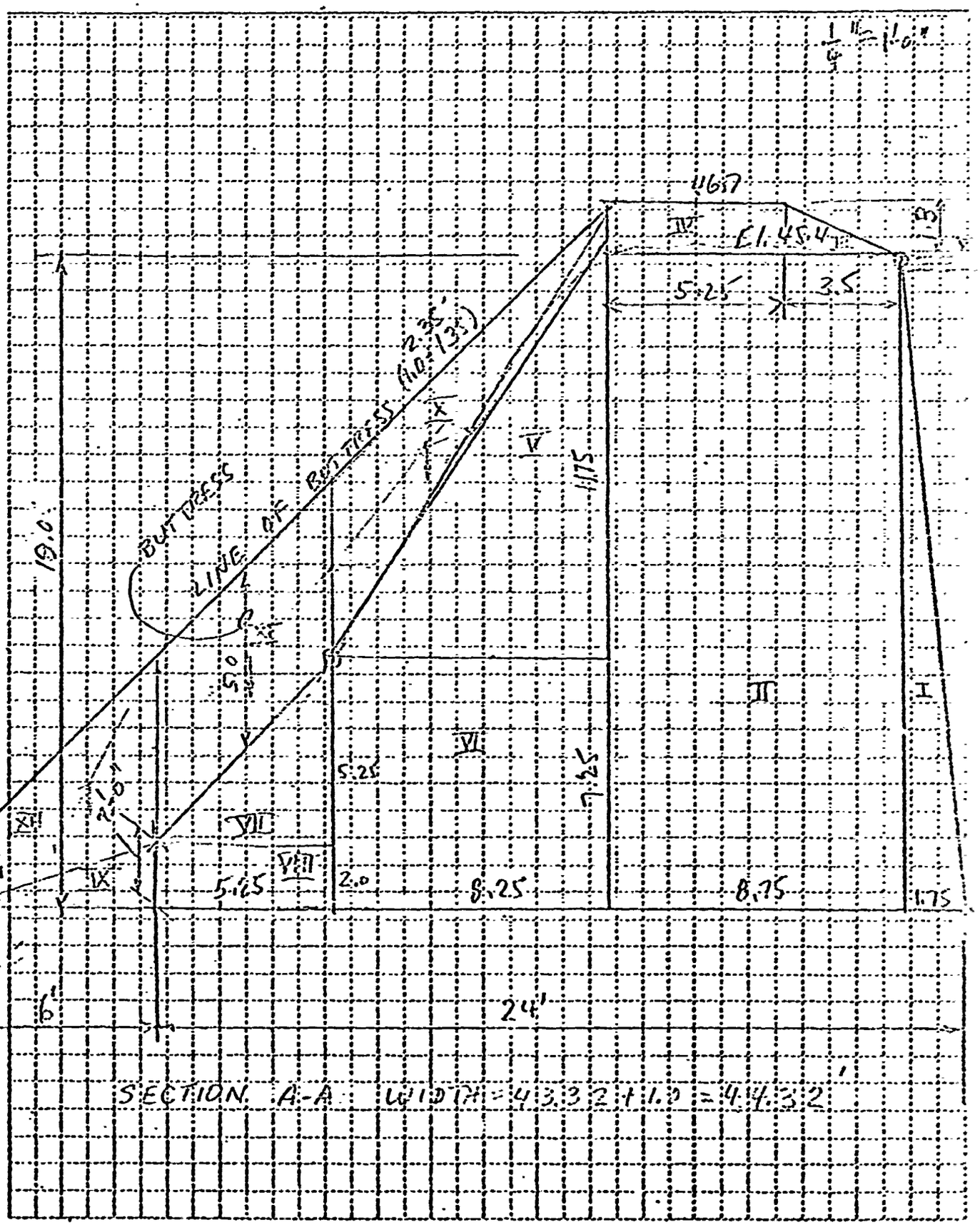
Sliding - Stability along the base of the structure is evaluated using the friction factor of safety (FFS) which is equal to $V \tan\phi / H$, where V is the sum of vertical forces acting on the base, H is the sum of all horizontal forces and $\tan\phi$ is Friction Factor - the stability with respect to sliding is considered adequate if the FFS exceeds 1.50 under normal loading conditions, 1.25 under unusual loading conditions and 1.1 under extreme loading conditions.

Job No. _____ Sheet 1 of _____

Project DAM CITY OF BEACON, N.Y. Date 8-4-80

Subject STABILITY ANALYSIS By HBL

OVERFLOW SECTION Ch'k. by _____



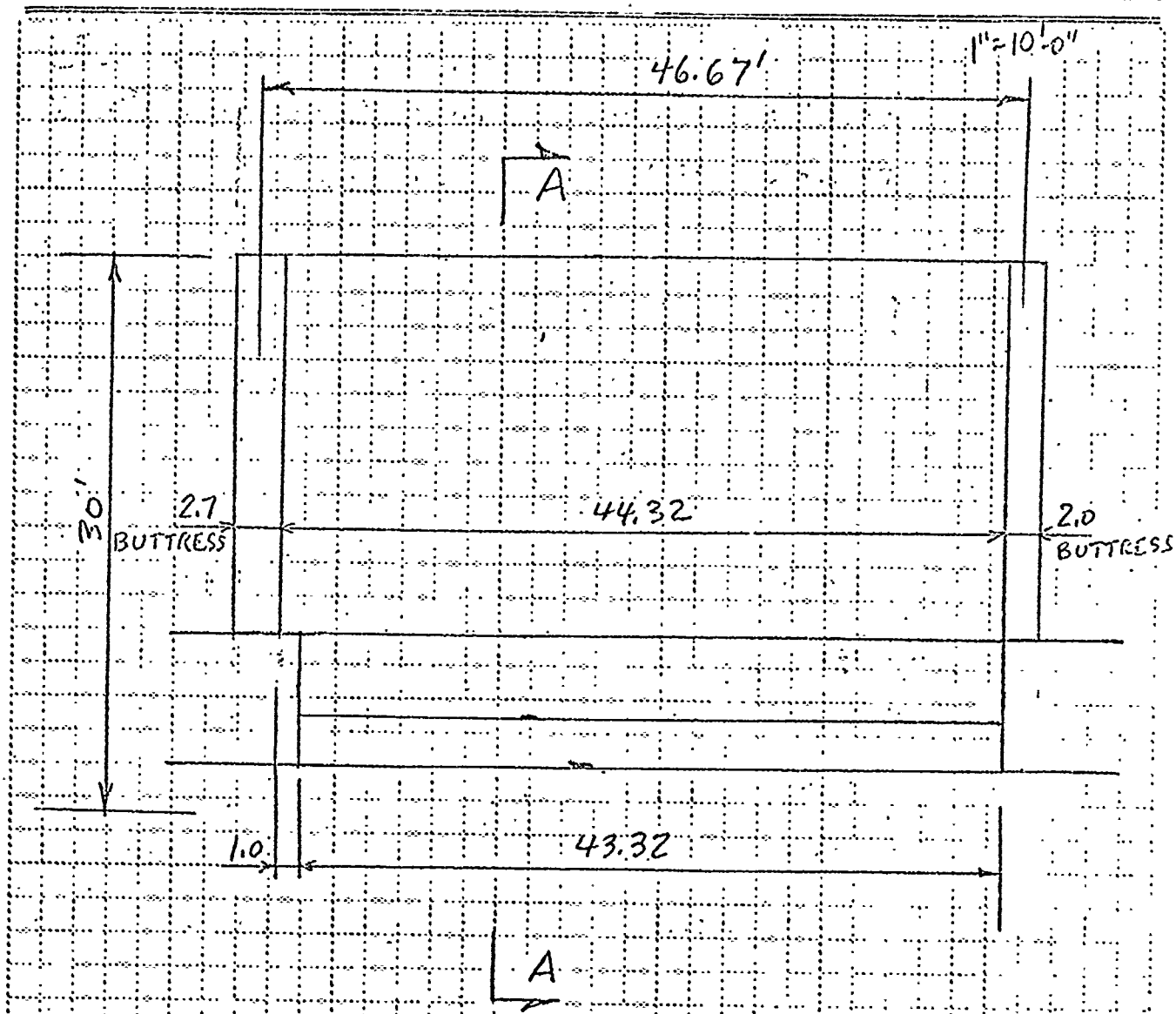
TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. _____ Sheet 2 of ___

Project DAM CITY OF BEACON Date 8-4-80

Subject STABILITY ANALYSIS By HBL

OVER FLOW SECTION Chk. by _____



PLAN

$A = 46.67 \times 30 = 1400\ FT^2$

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. _____ Sheet 3 of ___

Project DAM CITY OF BEACON, N.Y. Date 8-4-80

Subject STABILITY ANALYSIS By HBL

OVER FLOW SECTION Ch'k. by _____

DEAD LOADS

				M @ TOE
I	$19 \times 1.75 \times \frac{1}{2} \times 44.32 \times 0.150$ (6.648) =	110.52	× 28.83 =	3,186
II	$19 \times 8.75 \times 44.32 \times 0.150$ =	1105.23	× 23.87 =	26,382
III	$1.3 \times 3.5 \times \frac{1}{2} \times 3.35 \times 0.150$ =	1.14	× 27.7 =	31
IV	$1.3 \times 5.25 \times 3.35 \times 0.150$ =	3.43	× 23.87 =	82
V	$11.75 \times 8.25 \times \frac{1}{2} \times 44.32 \times 0.150$ =	322.22	× 16.75 =	5,397
VI	$7.25 \times 8.25 \times 44.32 \times 0.150$ =	397.63	× 15.38 =	6,116
VII	$5.25 \times 5.25 \times \frac{1}{2} \times 44.32 \times 0.150$ =	91.62	× 9.5 =	870
VIII	$2.0 \times 5.25 \times 44.32 \times 0.150$ =	69.80	× 8.63 =	602
IX	$2.0 \times 6.0 \times \frac{1}{2} \times 44.32 \times 0.150$ (.3525) =	39.89	× 4.0 =	160
X	$2.75 \times 16.0 \times \frac{1}{2} \times 2.35 \times 0.150$ =	7.76	× 14.5 =	112
XI	$7.5 \times 4 \times 2.35 \times 0.150$ =	10.58	× 9.15 =	97
XII	$8.5 \times 4.9 \times \frac{1}{2} \times 2.35 \times 0.150$ =	7.34	× 4.2 =	31
XIII	$1.5 \times 6.0 \times \frac{1}{2} \times 2.35 \times 0.150$ =	4.23	× 2.0 =	8
	$\bar{X} = \frac{44463}{2,227.31} = 19.96'$	2,171.39 K/F		43,074 Ft.K.

Job No. 1551-04 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK Sheet 4 of ___

Project ___ Date 8-4-80

Subject STABILITY ANALYSIS CASE 1 & 2 OVERFLOW By HBL

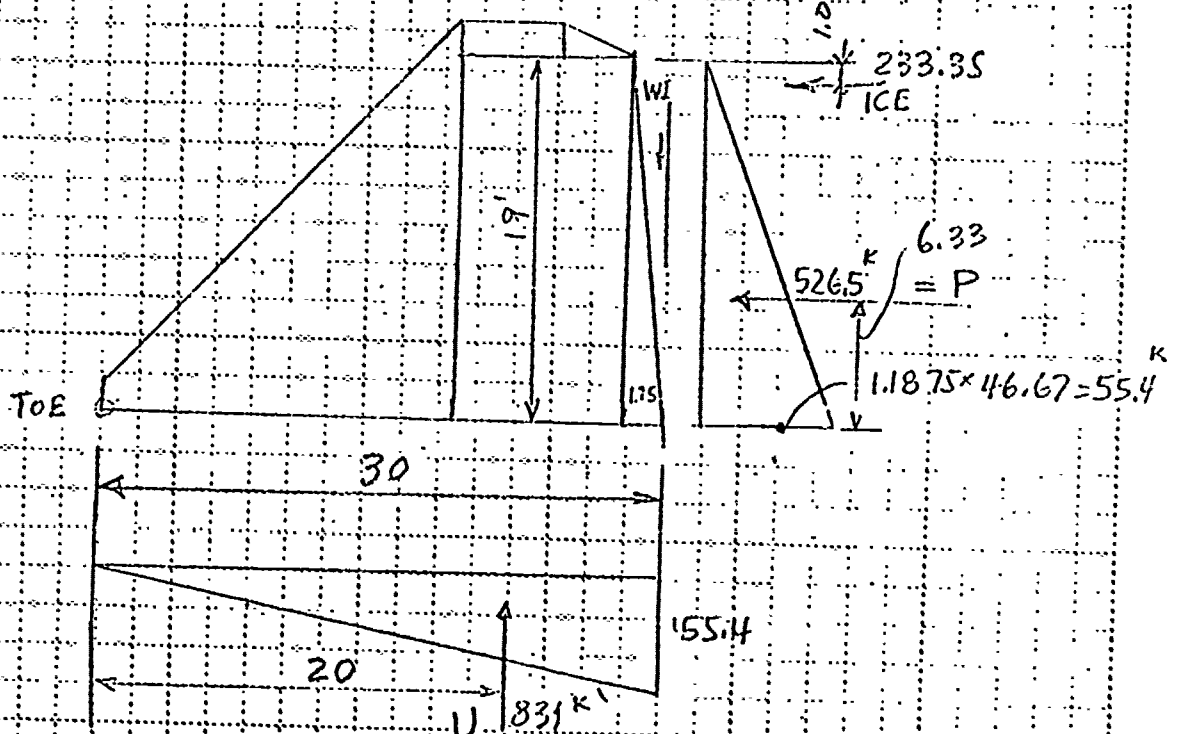
Chk. by ___

HYDROSTATIC FORCES

CASE I NORMAL LOADING WL @ CREST NO ICE

CASE II NORMAL LOADING WL @ CREST ICE 1'-0" BELOW CREST

$5 \times 46.67 = 233.35 \times 18 = 4200^{\text{K}}$,



$\downarrow$ WI $= 1.75 \times 19 \times \frac{1}{2} \times .0625 = 1.04 \times 46.67 = 48.5^{\text{K}} \times 29.42 = 1427^{\text{IK}}$ ↷

$\leftarrow$ P $= 526.5 \times 6.33 =$ 3333^{IK} ↶

$\uparrow$ U $= 831 \times 20 =$ $16{,}620^{\text{IK}}$ ↶

$19{,}953^{\text{IK}}$

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. _____ Sheet 5 of ___
Project DAM CITY OF BEACON, N.Y. Date 8-4-80
Subject STABILITY ANALYSIS CASE 1 By HBL
OVERFLOW SECTION Chk. by _____

NORMAL LOADING W/O ICE

SH 3 ↓ 2171.4 43074
SH 4 48.5 1427
2219.9 44,501

↑ 831
ΣV ↓ 1388.9 ΣM = 19,953 / 24,548 ft

$\frac{\Sigma M}{\Sigma V} = \frac{24,548}{1388.9} = 17.67'$

$e = \frac{30}{2} - 17.67 = 2.67'$ U/S FROM BASE ℄

RESULTANT WITHIN MIDDLE THIRD

1388.9 K/l
46.67 = 29.76

$p = \frac{29.76}{30}\left(1 \pm \frac{6 \times 2.67}{30}\right) = .992(1 \pm .534)$ (.534)

1.52 KSF
.46 10.6 PSF

$FFS = \tan\phi \frac{\Sigma V}{\Sigma H} = \frac{1388.9}{526.5} = 2.64$

Job No. _____ TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Project VAM CITY OF BEACON, N.Y. Sheet 6 of ___

Subject STABILITY ANALYSIS CASE 2 WITH ICE Date 8-4-80

OVERFLOW SECTION By HBL

Chk. by _____

FROM SH. 5 $\Sigma H = 526.5^K$ $\Sigma V = 1388.9^K$ $\Sigma M_5 = 24,548^{IK}$

SH.4 ICE $H = 233.35^K$ $M = 4200$

$\Sigma M_6 = 20,348^{IK}$

526.5
233.35
759.85

$x = \frac{20348}{1388.9} = 14.65$ $e = \frac{30}{2} - 14.65 = 0.35'$ O/S FROM BASE ℄

$p = \frac{29.76}{30}\left(1 \pm \frac{6 \times .35}{30}\right) = .992(1 \pm .07)$ 1.06, 0.92 KSF

$FFS = \frac{\tan\phi \Sigma V}{\Sigma H} = \frac{1388.9}{760} = 1.83 > 1.50^K$

$P_{AV} = \frac{V}{A} = \frac{1388.9}{1400} = 0.992$ KSF

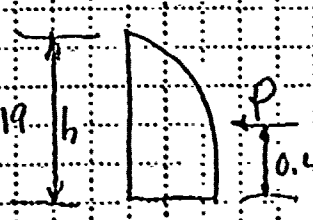
TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. 1551-04 Sheet 7 of ___
Project DAM CITY OF BEACON N.Y. Date 8-5-80
Subject STABILITY ANALYSIS By HBL
OVERFLOW SECTION CASE 5 Chk. by ___

CASE 5 EQ = 0.05 ZONE 2

I	110.52	× 0.05 =	5.5	× 6.33 =	34.8	
II	1105.23	=	55.3	× 9.50 =	525.4	
III	1.14	=	0.06	× 19.43 =	1.2	
IV	3.43	=	0.17	× 19.65 =	3.3	
V	322.22	=	16.1	× 11.17 =	179.8	
VI	397.63	=	19.9	× 3.63 =	72.2	
VII	91.62	=	4.6	× 3.75 =	17.3	
VIII	69.80	=	3.5	× 1.0 =	3.5	
IX	39.89	=	2.0	× .67 =	1.3	
X	7.76	=	0.4	× 13.5 =	5.4	
XI	10.58	=	0.5	× 7.5 =	3.8	
XII	7.34	=	0.4	× 3.7 =	1.5	
XIII	4.23	=	0.2	× 1.0 =	.2	
		←	108.6 K		849.7 IK	3s

HYDRODYNAMIC



C = 0.69

$P_e = C \lambda w h \tan\phi$ $\frac{1.75}{19.0} = .0921$ 5.26°

$V_e = P = 0.69 \times 0.05 \times .0625 \times 19^2 = .7784 \times 46.67 = 36.3$ ←

$M_p = 0.4 \times 19 \times 36.3 = 276$ IK

Job No. 1551-04 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK Sheet 8 of ___

Project DAM CITY OF BEACON N.Y. Date 8-6-80

Subject STABILITY ANALYSIS By HBL

OVERFLOW SECTION CASE 5 EQ (NO ICE) Chk. by ___

171.4
48.5
217.9
831.
1388.9

4501.
+9953
14,548

SH.3 ↓ 2171.4 K ↷ 43074 IK

SH.4 ↓ 48.5 ← 526.5 ↷ 1427 IK ↷ 19,953 IK

↑ 831

SH.5 ↓ 1388.9 = ΣV ↷ 24,548

SH.7 DL ← 108.6 K 850 IK

← 635.1 K 23,698 ↷

HYDRODYNAMIC ← 36.3 276

ΣH = ← 671.4 K ΣM = 23,422 ↷

$\frac{\Sigma M}{\Sigma V} = \frac{23,422}{1388.9} = 16.86'$ $e = \frac{30}{2} - 16.86 = 1.86$ U/S FROM BASE ℄

RESULTANT WITHIN MIDDLE THIRD

$p = \frac{29.76}{30}\left(1 \pm \frac{6 \times 1.86}{30}\right) = .992\,(1 \pm .37)$ (.37)

$p_{MAX} = 1.36\ K/FT^2 = 9.5\ psi$

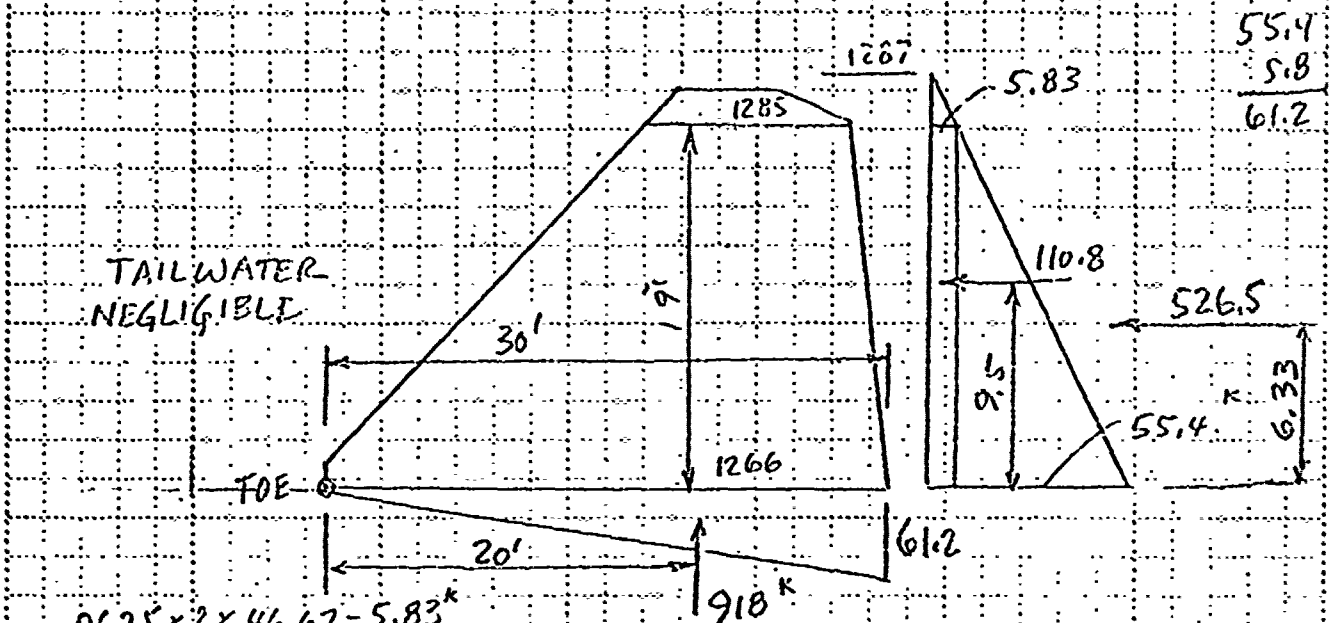
$p_{MIN} = 0.62\ K/FT^2$

$FFS = \tan\phi \frac{\Sigma V}{\Sigma H} = \frac{1388.9}{671.4} = 2.07 > 1.25$ OK

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. 1551-04 Sheet ___ of ___
Project DAM CITY OF BEACON N.Y. Date 8-6-80
Subject STABILITY ANALYSIS OVERFLOW SECTION By HBL
CASE 3 ½ PMF UNUSUAL L.C. Chk. by ___

LAKE LEVEL U/S 1287 D/S 1266.7 (NEGLECT



1285
19
1266

.0625 × 2 × 46.67 = 5.83 K

.0625 × 21 × 46.67 = 61.25

5.83

55.42

U = 918 × 20 = 18360 IK

P_1 = 526.5 × 6.33 = 3333

P_2 = 110.8 × 9.5 = 1053

ΣP = 637.3 K ← 22746 IK ↶

D.L. ↓ 2219.9 44501 ↷

918. 22746

ΣV = ↓ 1301.9 ΣM = 21,755 IK

$\frac{\Sigma M}{\Sigma V} = \frac{21,755}{1301.9} = 16.71$

$e = \frac{30}{2} - 16.71 = 1.71$ U/S FROM BASE ℄

RESULTANT WITHIN MIDDLE THIRD

$FFS = \tan\phi \frac{\Sigma V}{\Sigma H} = \frac{1301.9}{637.3} = 2.04 > 1.25$

Job No. 1551-04 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK

Project DAM CITY OF BEACON N.Y.

Subject STABILITY ANALYSIS OVERFLOW SECTION CASE 4 PMF EXTREME L.C.

Sheet ___ of ___

Date 8-7-80

By HBL

Chk. by ___

LAKE LEVEL U/S 1287.35 D/S 1267

BY INSPECTION, COMPARE WITH CASE 3 UNUSUAL L.C.

LOADS ALMOST SAME AS ½ PMF

∴ CASE 4 NOT CRITICAL

Job No. 1551 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK

Project DAM CITY OF BEACON N.Y. Sheet I of

Subject STABILITY ANALYSIS Date 8-4-80

NON OVERFLOW SECTION By HBL

Chk. by

ASSUMPTIONS

1) THE UNIT WT OF CONCRETE ASSUMED 150 pcf

2) ICE LOAD OF 5000 psf ACTING 1 FOOT FROM TOP OF DAM (C. OF E. CRITERIA)

3) DAM SITE IS SEISMIC ZONE 2

LOADING CONDITION

CASE 1) NLC LAKE LEVEL @ SPILLWAY CREST, NO ICE LOAD

CASE 2) NLC " " WITH ICE LOAD

3) UNUSUAL ~~EXCEPTIONAL~~ LC LAKE LEVEL @ $\frac{1}{2}$ PMF

4) EXTREME LC " " @ PMF

STABILITY CRITERIA:

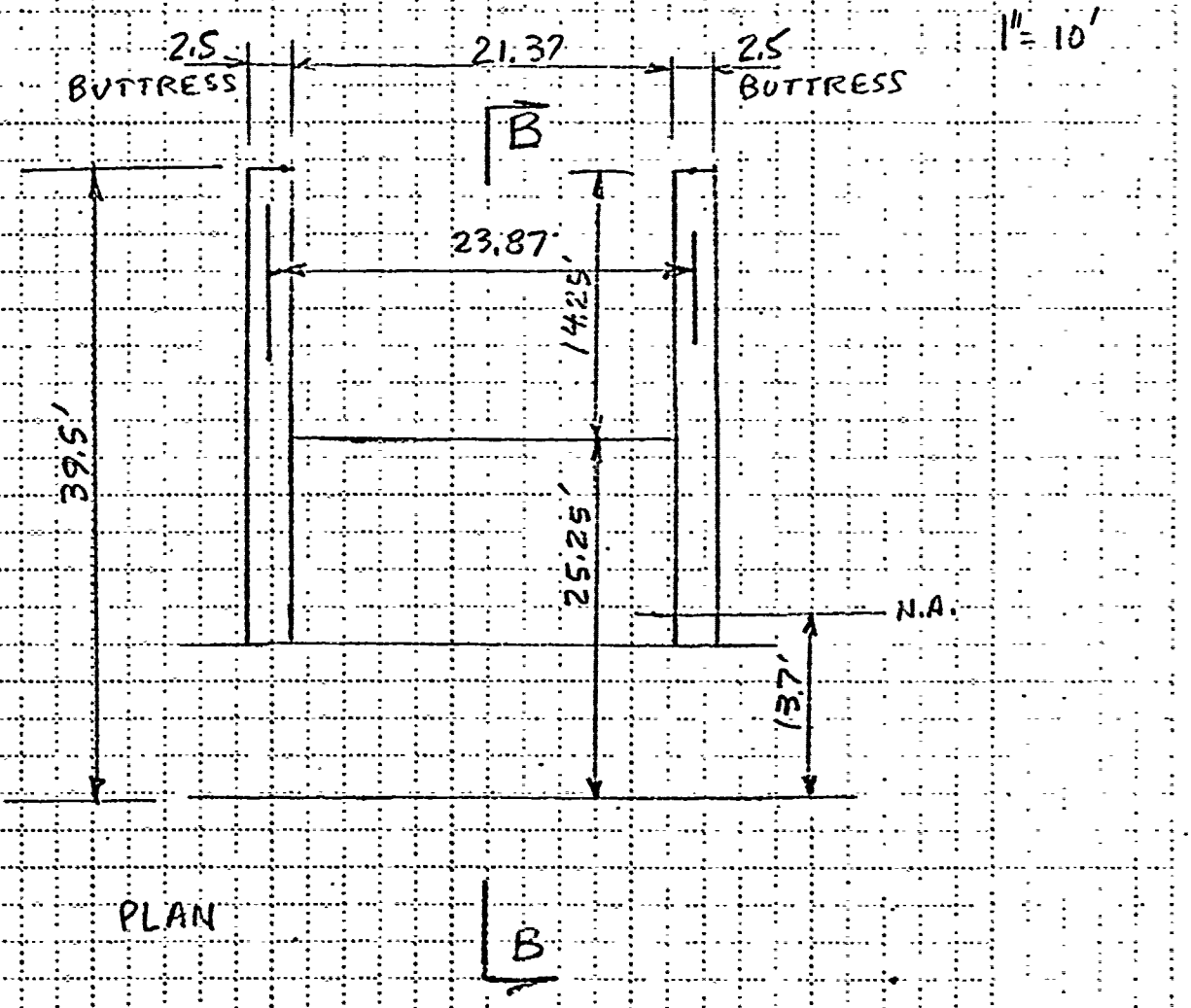
The stability criteria against overturning and sliding were evaluated as follows.

Overturning - Stability is considered adequate if the resultant of all forces falls within the middle third of the base under the normal loading condition and within middle half of the base under the unusual and extreme loading conditions.

Sliding - Stability along the base of the structure is evaluated using the friction factor of safety (FFS) which is equal to $V \tan\phi / H$, where V is the sum of vertical forces acting on the base, H is the sum of all horizontal forces and $\tan\phi$ is Friction Factor - the stability with respect to sliding is considered adequate if the ϕ exceeds 1.50 under normal loading conditions, 1.25 under unusual loading conditions and 1.1 under extreme loading conditions.

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. 1551-04 Sheet ___ of ___
Project DAM CITY OF BEACON, N.Y. Date 8-4-80
Subject STABILITY ANALYSIS CASE I By HBL
NON OVERFLOW SECTION Chk. by ___



PLAN

A_1 $2.5 \times 39.5 = 98.8 \times 19.5 = 1927$

A_2 $21.37 \times 25.25 = 539.6 \times 12.63 = 6815$

$638.4\ FT^2$ $8742\ FT^3$

$$x' = \frac{3742}{638.4} = 13.7$$

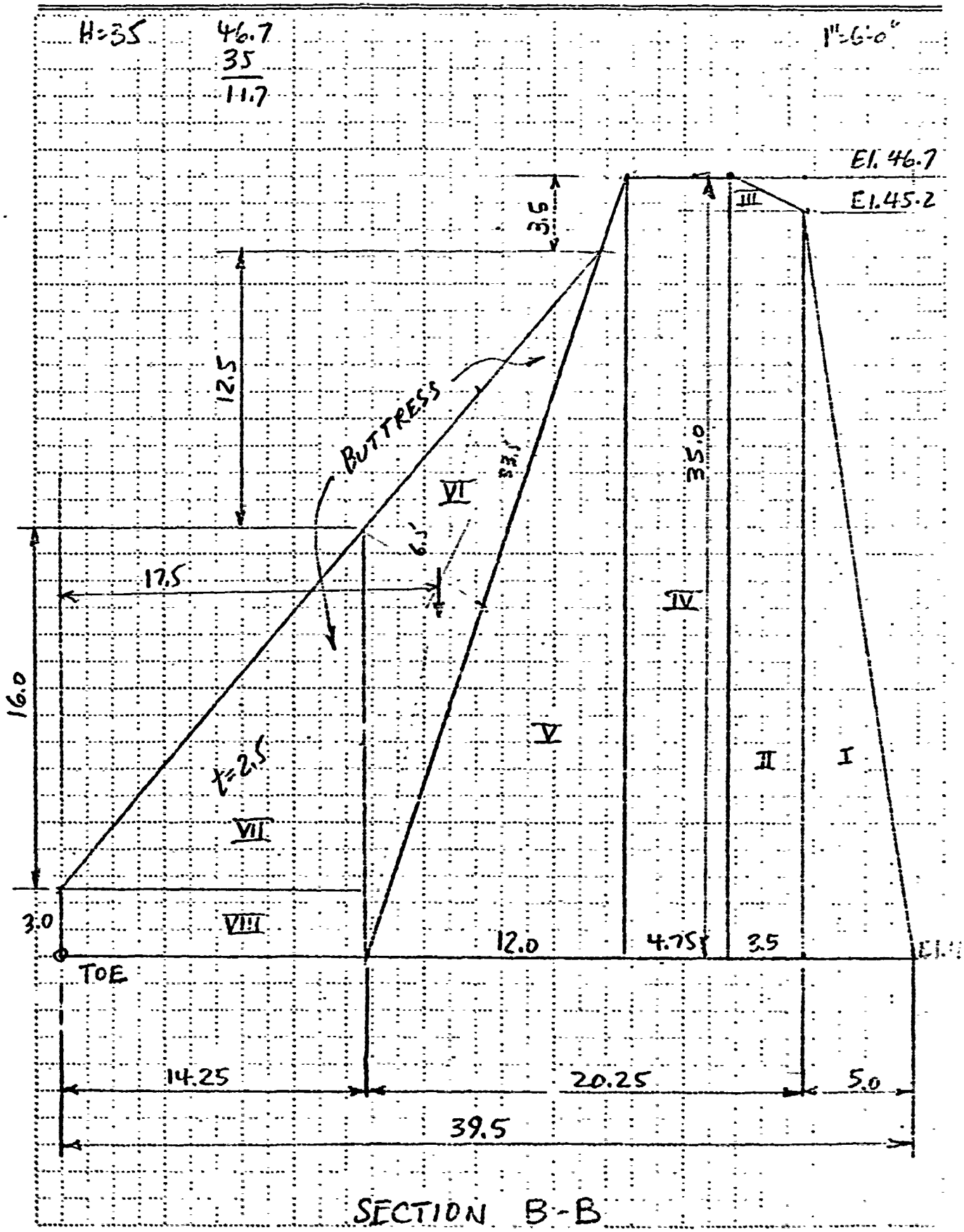
TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. _____ Sheet ___ of ___

Project DAM CITY OF BEACON, N.Y. Date 8-4-90

Subject STABILITY ANALYSIS CASE I By HBL

NON OVERFLOW SECTION Chk. by _____



TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. _____ Sheet ___ of ___
Project DAM CITY OF BEACON, N.Y. Date 3-4-60
Subject STABILITY ANALYSIS CASE I By HPL
NON-OVER FLOW SECTION Chk. by _____

DEAD LOADS

I	$33.5 \times 5.0 \times \frac{1}{2} \times 21.37 \times 0.150$ (3.2055)	=	268.84	× 36.17	= 9,724
II	$33.5 \times 3.5 \times 21.37 \times 0.150$	=	375.85	× 32.75	= 12,309
III	$1.5 \times 3.5 \times \frac{1}{2} \times 21.37 \times 0.150$	=	26.97	× 32.17	= 868
IV	$35 \times 4.75 \times 21.37 \times 0.150$	=	112.19	× 28.62	= 3,211
V	$35 \times 12 \times \frac{1}{2} \times 21.37 \times 0.150$	=	673.16	× 22.25	= 14,978
VI	$33.5 \times 6.5 \times \frac{1}{2} \times 2.5$ (.375) $\times 0.150$	=	40.83	× 17.5	= 715
VII	$16 \times 14.25 \times \frac{1}{2} \times 2.5 \times 0.150$	=	42.75	× 9.5	= 406
VIII	$3 \times 14.25 \times 2.5 \times 0.150$	=	16.03	× 7.13	= 114

$\bar{x} = \frac{42,325}{1556.62} = 27.19'$ ↓ $\frac{3344}{1,556.62^{K}}$ (+) $\frac{4.24}{42,325}$'

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. _____ Sheet ___ of ___
Project DAM CITY OF BEACON Date 8-5-80
Subject STABILITY ANALYSIS By HBL
NON OVERFLOW SECTION Ch'k. by _____

HYDROSTATIC FORCES

1"=10'-0"

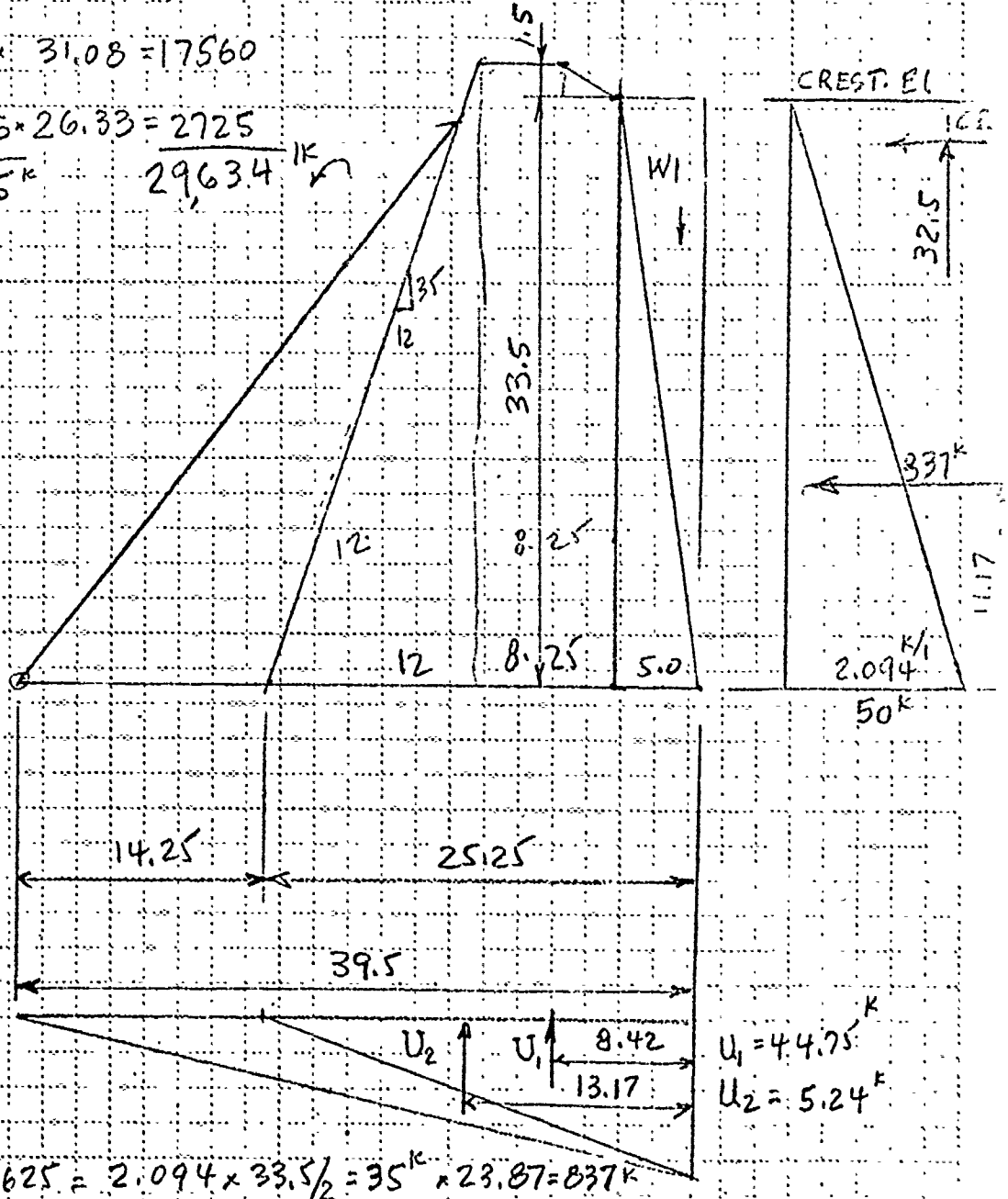
$\downarrow W_1 = 5 \times 33.5 \times \frac{1}{2} \times .0625 = 5.23^K \times 23.87 = 124.84 \times 36.17 = \curvearrowright 4515$

$\leftarrow P = 837 \times 11.17 = 9349^K \curvearrowleft$

$\uparrow U_1 = 565 \times 31.08 = 17560$

$U_2 = 103.5 \times 26.33 = 2725$

$\uparrow 668.5^K \quad 29,634^{IK} \curvearrowleft$



39.5 / 13.17 / 26.33 → U2

39.5 / 8.42 / 31.08 → U1

$P = 33.5 \times .0625 = 2.094 \times 33.5/2 = 35^K \times 23.87 = 837^K$

$U_1 = 2.094 \times 21.37 = 44.75^K$

U_2 $2.094 \times 2.5 = 5.24^K$

$2.094 \times 23.87 = 50^K$

$U_1 = 44.75 \times 25.25/2 = 565^K$

$U_2 = 5.24 \times 39.5/2 = 103.5^K$

668.5^K

Job No. 1551-04 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK Sheet ___ of ___

Project DAM CITY OF BEACON N.Y. Date 8-5-80

Subject STABILITY ANALYSIS By HBL

NON OVER FLOW SECTION CASES 1 AND 2 Ch'k. by ___

CASE 1 NORMAL LOADING NO ICE

SH.3	↓ 1556.62 K	42,325 IK	↷
SH.4	↓ 124.84	4515	
	↓ 1681.46 K	46,840 IK	
	↑ 668.5	29634	↶
ΣV =	↓ 1012.96	17,206	↷

ΣH = 837 K

$FFS = \frac{\Sigma V \tan\phi}{\Sigma H} = 1.21$

$\bar{x} = \frac{\Sigma M}{\Sigma V} = \frac{17206}{1013} = 16.99'$

CASE 2 NORMAL LOADING WITH ICE 1'-0" BELOW CREST

ICE $23.87 \times 5 = 119.35 \times 32.5 = 3879$ IK

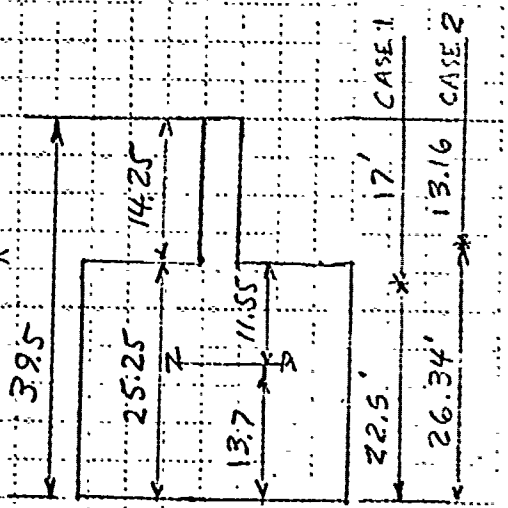
$\Sigma H = 837 + 119.35 = 956.35$ K

FRICTION FACTOR OF SAFETY $FFS = \frac{\Sigma V \tan\phi}{\Sigma H} = \frac{1012.96}{956.35} = 1.06$

$\Sigma M = 17206 - 3879 = 13327$ IK

$\bar{x} = \frac{\Sigma M}{\Sigma V} = \frac{13327}{1013} = 13.16'$

RESULTANT ' FROM N.A.



NOTE IF ENTIRE BASE IS NOT IN COMPRESSION REVISE UPLIFT FORCES.

$\bar{x}$ = LOCATION OF RESULTANT ΣV

Job No. 1551-04 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK Sheet ___ of ___

Project DAM CITY OF BEACON N.Y. Date 8-5-80

Subject STABILITY ANALYSIS By HBL

NON OVERFLOW SECTION Chk. by ___

CASE 5 EQ. = 0.05 ZONE 2

I	268.84	× .05 =	13.4	× 11.17 =	150	
II	375.85		18.8	× 16.75 =	315	
III	26.97		1.35	× 34.0 =	46	
IV	112.19		5.6	× 17.5 =	98	
V	673.16		33.7	× 11.67 =	393	
VI	40.83		2.0	× 17.0 =	34	
VII	42.75		2.1	× 8.33 =	17	
VIII	16.03		0.8	× 1.5 =	1	
		←	77.75 K		1054 IK	↶

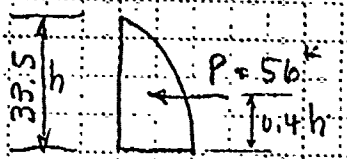
HYDRODYNAMIC

ZANGERS METHOD

C = 0.67 @ BASE

$\tan\psi = \frac{5}{33.5} = .14925$ $\psi = 8.4$

$C = .67$



$P_e = C\lambda\omega h$ $V_e = P_{ey}$

$V_e = P = .67 \times 0.05 \times .0625 \times 33.5^2 = 2.35 \times 23.87 = 56$ K/l

$M_p = 0.4 \times 33.5 \times 56 = 750$ IK ↶

56
78
837
971

Job No. 1551 — TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK — Sheet ___ of ___

Project DAM CITY OF BEACON N.Y. — Date 8-5-80

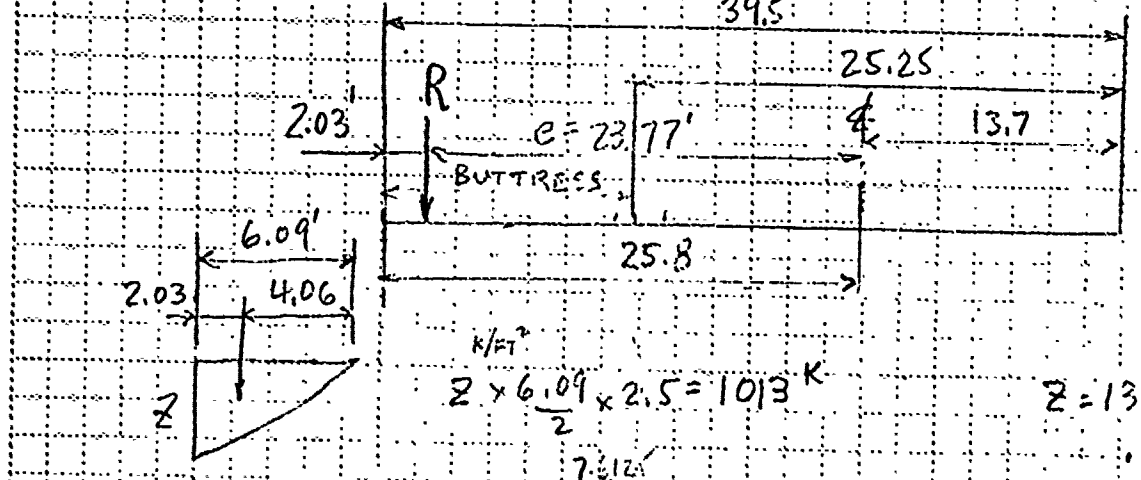
Subject STABILITY ANALYSIS NON OVERFLOW SECTION CASE 5 UNUSUAL L.C. — By HBL — Chk. by ___

WATER LEVEL @ SPILLWAY CREST EQ = 0.05g

DEAD LOADS	↓ 1557 K	↷ 42,325 IK		
HYDRO "	WI ↓ 125 K	↷ 4515 IK	} 46840 IK	
	U ↑ 669 K	↶ 29634 IK		
837	← P_{HYDRO} 837 K	↶ 9349 IK		
78	← EQ_{DL} 78 K	↶ 1054 IK	} 44787 IK	
56	← EQ_{HYDRO} 56 K	↶ 750 IK		
971				
1682		↶ ΣM = 2052 IK		
669				
1013				

$$FFS = \frac{\tan\phi \Sigma V = 1013^K}{\Sigma H = 971} = 1.04$$

LOCATION OF RESULTANT $\frac{\Sigma M}{\Sigma V} = \frac{2053}{1013} = 2.03'$



39.5
15.73
23.77

$$Z \times \frac{6.09}{2} \times 2.5 = 1013^K$$

$Z = 133^{K/FT^2}$

$= .924^{K/IN^2}$

UNDER BUTTRESS

I RESULTANT OUTSIDE MIDDLE HALF AND ALMOST OUTSIDE OF STRUCTURE

II ROCK BEARING STRESS 133 KIP/FT² IS EXCESSIVE

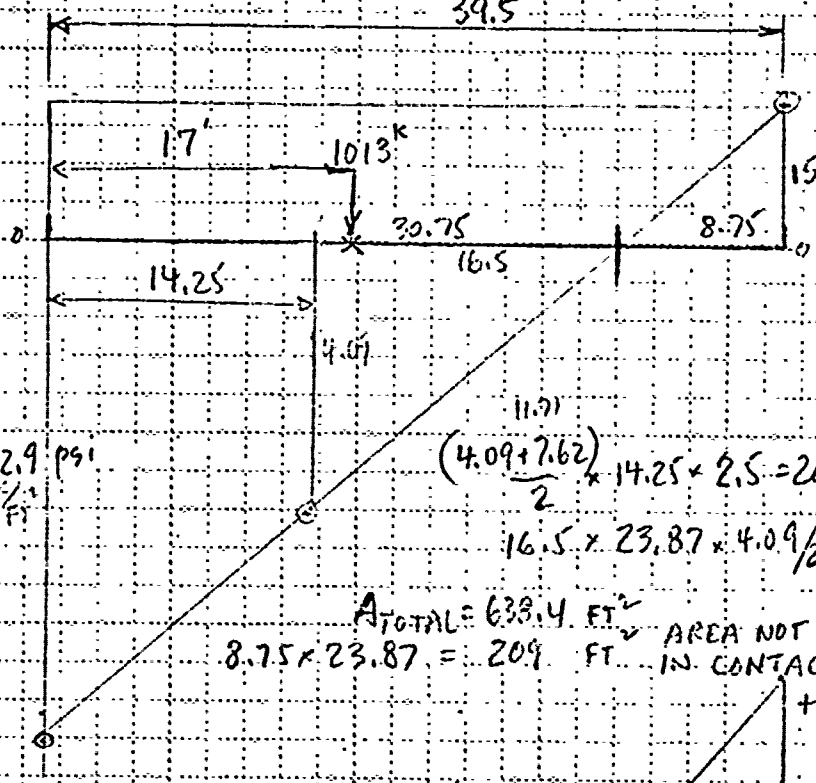
TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. 1551-04 Sheet 10 of ___
Project DAM CITY OF BEACON N.Y. Date 8-7-80
Subject STABILITY ANALYSIS NON OVERFLOW SECTION By IPL
CASES 1 AND 2 BASE AREA Chk. by ___

CASE 1

15.05
52.90
67.95

$\frac{67.95}{39.5} = \frac{15.05}{x}$ $x_1 = 8.75$



$\frac{x}{16.5} = \frac{7.62}{30.75}$ $x_2 = 4.09$ K/FT²

52.9 PSI
7.62 K/FT²

$\left(\frac{4.09+7.62}{2}\right) \times 14.25 \times 2.5 = 208.6$

$16.5 \times 23.87 \times 4.09/2 = 805$

1013+

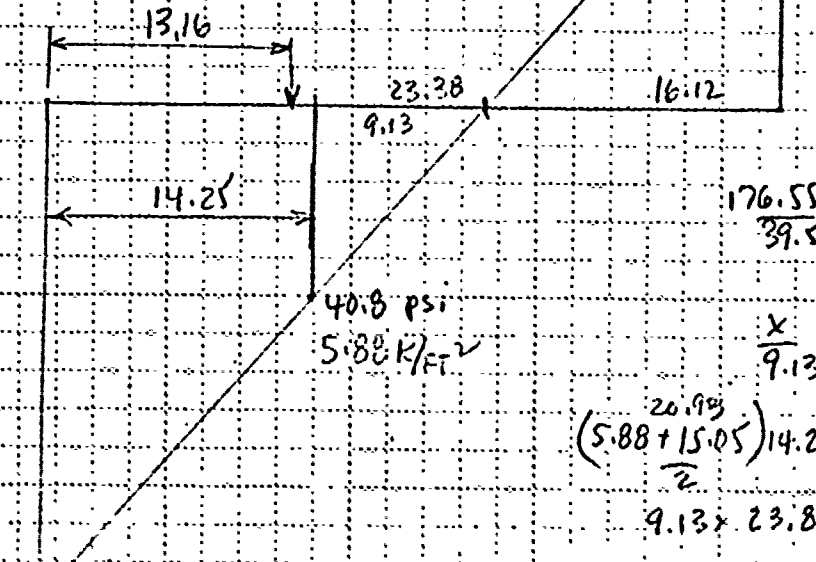
$A_{TOTAL} = 638.4$ FT²

$8.75 \times 23.87 = 209$ FT² AREA NOT IN CONTACT $= 33\%$

+72.05

72.05
104.5
176.55

CASE 2



23.38
14.25
9.13

$\frac{176.55}{39.5} = \frac{72.05}{x}$ $x_1 = 16.12$

$\frac{x}{9.13} = \frac{104.5}{23.38}$ $x_2 = 40.8$

$\left(\frac{5.88+15.05}{2}\right) 14.25 \times 2.5 = 372.8$

$9.13 \times 23.87 \times 5.88/2 = 640.7$

1013.5

$16.12 \times 23.87 = 384.8$ AREA NOT IN CONTACT

$\frac{384.8}{638.4} = 60.3\%$

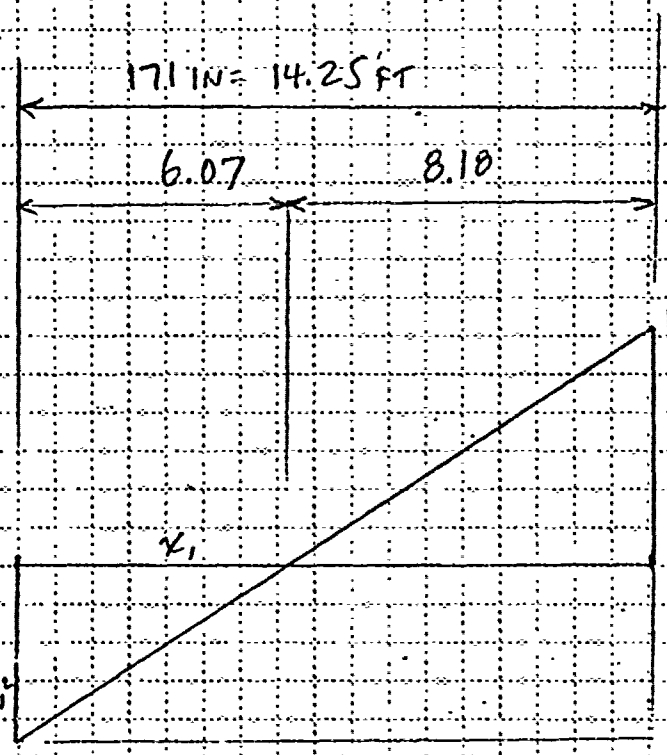
Job No. 1551-04 TIPPETTS-ABBETT-McCARTHY-STRATTON ENGINEERS AND ARCHITECTS NEW YORK Sheet 8 of ___

Project BEACON RESERVOIR Date 8-6-90

Subject STABILITY ANALYSIS NON OVERFLOW MONOLITH CASE 5 By HBL

Chk. by ___

COMPUTER CHECK



$132.5\ K/FT^2$

$$\frac{x_1}{.92} = \frac{171}{2.16}$$

$$x = 72.8\ IN = 6.07\ FT$$

$$\frac{x_2}{1.24} = \frac{171}{2.16}$$

$x = 98.17$ IN

8.18 FT

1551-04

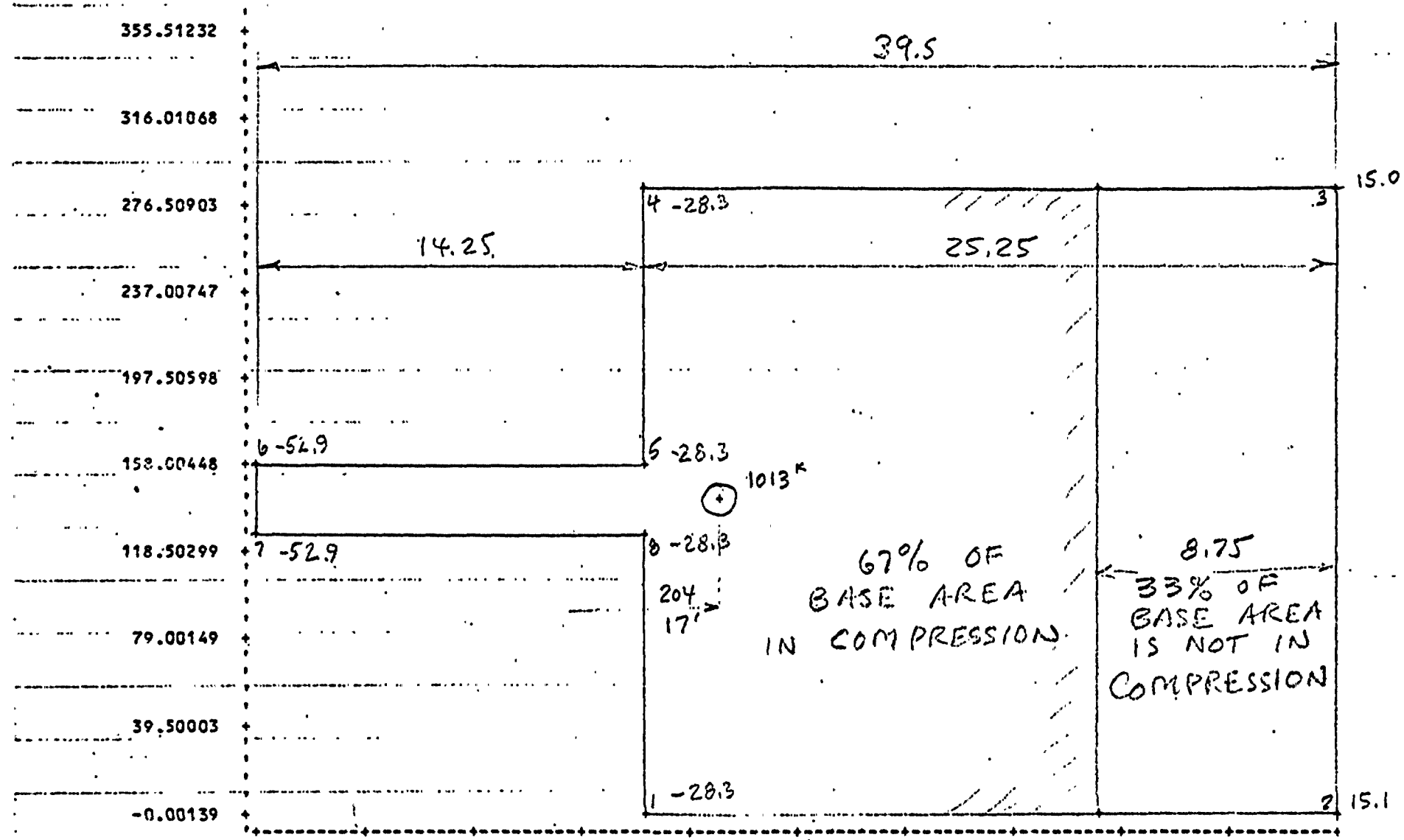
DAM CITY OF BEACON, N.Y.

NON-OVERFLOW SECTION CASE I

STRESS psi

8-7-80

HBL



SH10A

1551-04

8-7-80
HBL
Sh 1 of 2

DAM CITY OF BEACON N.Y.
STRUCTURAL STABILITY ANALYSIS
NON OVERFLOW SECTION

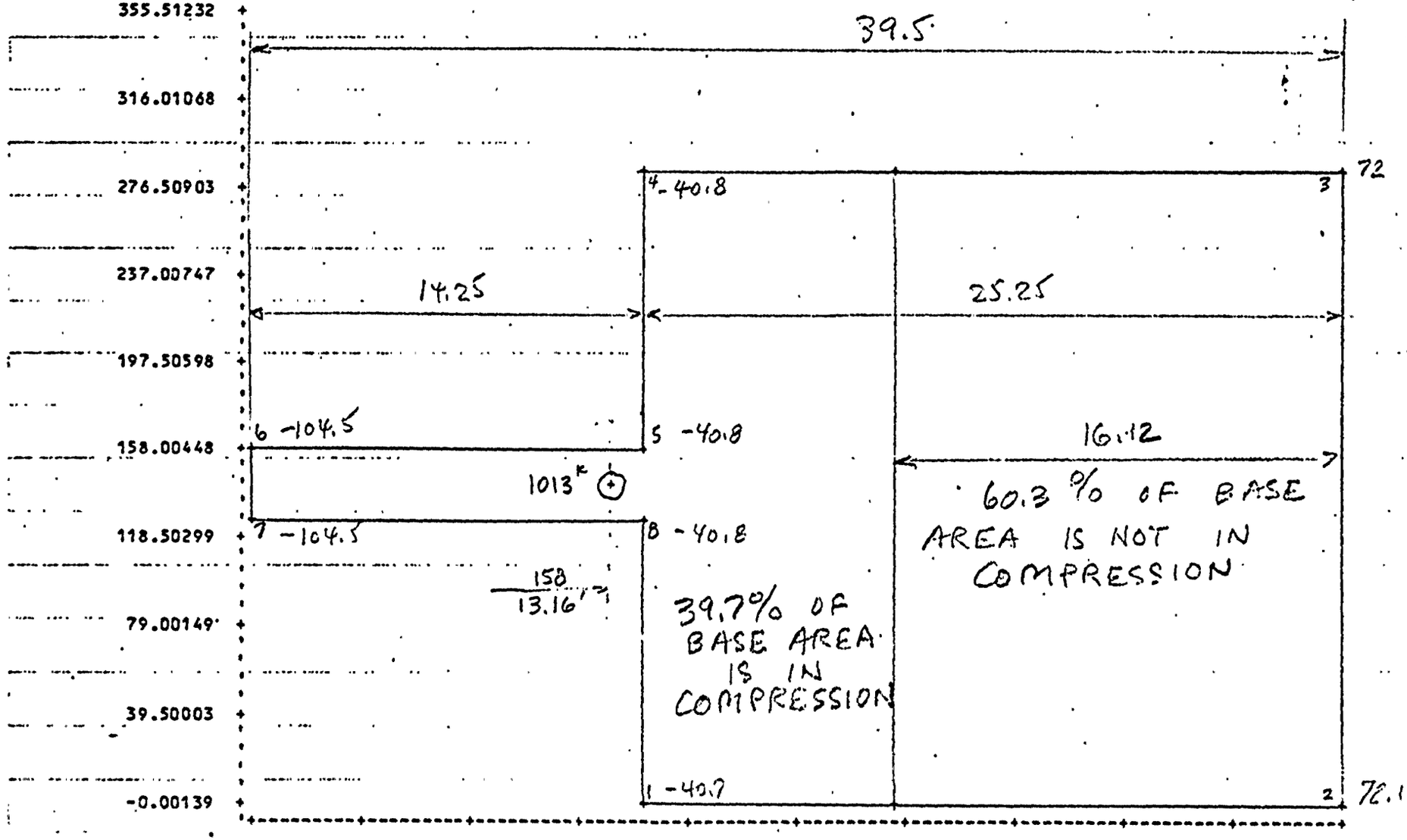
CASE 1) NORMAL LOADING CONDITION: RESERVOIR LEVEL AT SPILLWAY CREST EL. 1285; NO ICE LOAD

FIRST TRIAL - Base area assumed 100% in compression with uplift varying linearly from 100% of head water at heel to zero at toe. Calculations indicate that, with this assumption, only 67% of base area is actually in compression and sliding F.S. = 1.21 These results indicate that the section is inadequate for CASE 1 especially since a second trial would produce a lower percentage of base in compression and a lower sliding F.S. A revised uplift diagram would decrease the vertical load and reduce the stabilizing moment.
The base area should be 100% in Compression for the normal loading condition.

CASE 2)

Same as CASE 1 with ice load added.
FIRST TRIAL: With base area assumed 100% in Compression, calculations indicate that only 39.7% of base area is in compression and sliding F.S. = 1.06. These results indicate that the section is inadequate for CASE 2. See comments to case 1.

DAM — CITY OF BEACON N.Y.
NON-OVERFL SECTION CASE 2
STRESS ps



1551-04

8-7-80
HBL
Sh 2 of 2

STRUCTURAL STABILITY ANALYSIS
NON OVERFLOW SECTION

CASES 3 AND 4) These cases are less critical than case 2 because of the magnitude of the ½ PMF and PMF water levels which are only slightly higher than the normal loading conditions
½ PMF is considered an UNUSUAL LOADING CONDITION
PMF is considered an EXTREME LOADING CONDITION

CASE 5) UNUSUAL LOADING CONDITION
Lake level at Spillway crest EL. 1285
plus EQ. = 0.05 g.

FIRST TRIAL - Base assumed 100% in compression calculations indicate a sliding F.S. = 1.04, ~~rock~~ pressure on rock = 133 kip per square foot and a very small percentage of the base in compression. A second trial with a revised uplift diagram would indicate less favorable results. The section is inadequate for case 5.

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS NEW YORK

Job No. 1551-04 Sheet A of ___
Project DAM CITY OF BEACON Date 8-6-80
Subject STABILITY ANALYSIS NON OVERFLOW SECTION By HBL
INDEX Ch'k. by ___

SHEET No. DESCRIPTION

I. ASSUMPTIONS, LOADING CONDITIONS & STABILITY CRITERIA

1) PLAN — BETWEEN BUTTRESSES

2) TYPICAL CROSS SECTION D.L. MARKS

3) DEAD LOADS

4) HYDROSTATIC FORCES

5) CASE 1 SUMMARY NORMAL LOADING W/O ICE

COMPUTER CHECK

F.F.S = 1.21 < 1.50 N.G

CASE 2

F.F.S = 1.06 < 1.50 N.G.

6) CASE 5 NORMAL LOADING WITH EQ = 0.05 LAKE LEVEL 1285
D.L & HYDRODYNAMIC LOADS

7) CASE 5 SUMMARY RESULTANT OUTSIDE MIDDLE HALF

F.F.S = 1.04 < 1.25 $\sigma_{MAX} = 133\ k/FT^2$

8) COMPUTER CHECKED MANUALLY

9) CASES 3 AND 4 ARE LESS CRITICAL THAN CASE 2
BY INSPECTION

10, 10A, 10B) BASE AREA IN COMPRESSION

REFERENCES

APPENDIX F

References

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3. "Standard Project Flood Determination", EM-1110-2-1411, Army Corps of Engineers, Washington, D.C., Rev. 1965

4. "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6,12,24 and 48 Hours",Hydrometerological report No.33. April 1956.

5. "National Program of Inspection of Dams", Vol. 3, Department of the Army, Office of the Chief of Engineers, 1975

6. "Flood Hydrograph Analyses and Computations", EM-1110-2-1405, U.S. Army Corps of Engineers, August, 1959

7. "Recommended Guidelines for Safety Inspection of Dams", Department of the Army, Office of the Chief of Engineers, Appendix D

8. "The Geology of New York State", by Broughton, J.E., et al., N.Y. State Museum and Science Service, Geological Survey, Albany, New York, Map and Chart Series: No. 5, 1962

9. "Soil Association Map of New York State", by M.G. Cline, New York State College of Agriculture, Cornell University, Ithaca, New York, February, 1963

10. "Orange County Soils. Soil Association Leaflet 2", by E.G. Knox, et al., New York State College of Agriculture, Cornell University, Ithaca, New York, October, 1954

OTHER DATA

APPENDIX G

Dam No. 557 Town Hud.

COMR MOORE

OCT. 7 JAN 1913 CHAIRMAN

DIVISION INLAND WATERS

JOHN D. MOORE Chief Engineer

ALBERT E. HOYT SECRETARY

JOHN J. FARRELL ASST. SECRETARY

STATE OF NEW YORK

DIVISION OF FORESTRY

JOHN D. MOORE

JAMES S. WHIPPLE DEPUTY COMMISSIONER

RICHARD W. SHERMAN CHIEF ENGINEER

ALEX. RICE McKIM INSPECTOR OF DOCKS AND DAMS

CONSERVATION COMMISSION

ALBANY

RECEIVED

OCT 8 1913

DIVISION INLAND WATERS

J. D. M.

Serial No. 132

Application filed Oct 27th 1913

Approved by Commission Nov 10th 1913

Material Tag No.

Foundations inspected

Final inspection

Albany, N. Y. 10/10 3

This application for the ~~reconstruction~~ construction of a dam has been examined by C R P of the Forestry Bureau, and we find that the proposed dam will not cause the flooding of any part of the Forest Preserve.

C. R. Pettit

APPLICATION FOR CONSTRUCTION OR RECONSTRUCTION OF A DAM

Beacon N.Y.

(Address of Applicant)

Application is hereby made to the Conservation Commission of the State of New York, in compliance with the provisions of Chap. LXV of the Consolidated Laws, the Conservation Law, for approval of the detailed specifications and plans, marked

Suggested Method of Reconstructing Beacon Dam

herewith submitted, for the {construction / ~~reconstruction~~} of the dam herein described. All provisions of law will be complied with in the erection of the said dam, whether specified herein or not.

October 4th 1913

(Date)

{Signature of Applicant} Morad Lamont

Comm Sec't

LOCATION AND GENERAL DATA

Site of dam is on ..... (Name of stream)

a branch of ..... (Name of stream), within the limits of the town of Town of Bethel, County of Dutchess

(Give approximate distance from well-known bridge, dam, village or mouth of stream, so that work can be located on map of state)

about one (1) Mile from Beacon

Purpose of dam Municipal Water Supply — City of Beacon.

Reasons for making changes in existing structure It is possible that the existing structure might fail if subjected to the pressure of the full reservoir

DATA AND DIMENSIONS

General:

Materials of which dam is to be constructed The present dam is rubble masonry with concrete face (down stream) and concrete buttresses. The additions are to be concrete

Area of watershed above dam 0.27 square miles.

Area of water surface of pond at level of spillway crest 2.8 acres.

Capacity of reservoir (at above level) 25,000,000 cubic feet.

Length of spillway crest ..... feet.

Maximum depth of water on spillway crest Spillway is 15 ft. below top of dam feet.

Maximum discharging capacity of spillway 17" days 250 cubic feet per second.

Maximum discharging capacity of spillway per square mile of drainage area 925 cubic feet per second.

Length on top ..... about 300 ..... feet.

Length in stream bed ..... " 250 ..... feet.

Maximum height above stream bed ..... " 20 ..... feet.

Maximum height above foundation bed ..... 35 ..... feet.

Maximum width of base ..... about 19 ..... feet.

Maximum width of top ..... 7½ ..... feet.

Elevation of top above maximum water level in pond ..... 1.5 ..... feet.

Elevation of top above spillway crest ..... 1.5 ..... feet.

Nature of foundations ..... Ledge .....

Earth portion: None

Embankment:

Length on top ..... feet.

Length in stream bed ..... feet.

Maximum height above stream bed ..... feet.

Maximum width of base ..... feet.

Maximum width of top ..... feet.

Elevation of top above maximum water level in pond ..... feet.

Elevation of top above spillway crest ..... feet.

Slope, upstream face .....

Slope, downstream face .....

Core wall: None

Material .....

Elevation of top above spillway crest ..... feet.

Width of top ..... feet.

Batter of faces .....

Maximum height above foundations ..... feet.

Maximum width of base ..... feet.

1

Fill out a form as complete as possible for each dam in your district and send to State Conservation Commission, Albany, N. Y.

1. Name and address of owners Village of Mattituck N.Y.
2. Date of construction 1889 — 1892 — 1901
3. Uses of impounded water Household and Municipal
4. Character of foundation bed Rock
5. Material of waste spill Concrete
6. Length of waste and depth below dam 43 ft — 1 ft 3 1/4 in
7. Total length of dam including waste 314 ft
8. Material of dam Stone and Concrete Masonry
9. Discharges, size and location 20 in pipe near bottom of dam

Below sketch section of waste and section of dam, with greatest heights and top thickness and bottom thickness. On opposite side sketch general plan of dam and give distance from a bridge or from a tributary stream.

Nearest town Southold

A. J. Conkling Mattituck N.Y.
(Signature, address and date.)

additional location

May 2nd

REPORT ON COMPLETION OF WORK

CONSERVATION COMMISSION — DIVISION OF INLAND WATERS

Albany.....

On.....I inspected the above work and found that it had been completed in a satisfactory manner.

Approved:

.....
Inspector of Docks and Dams.

.....
Chief Engineer.

INSTRUCTIONS TO APPLICANTS

Requirements for Plans.—Before beginning the construction, reconstruction, alteration or extension of a structure for impounding water, the owner of the proposed structure shall submit, in duplicate, to the Conservation Commission complete drawings showing the location of the dam, the flow line of the impounded water, the boundary lines and the ownership of the property affected, the nature of the foundation bed, the character of the materials to be employed, the size and the location of the discharge and control gates, the general and special features of the dam, and such dimensions as are necessary for the calculation of the stresses and the erection of the structure.

Drawings shall be on sheets of uniform size 24 inches wide by 36 inches long. Each sheet shall have a white space 2¾ inches high by 5¼ inches long below the title to receive the stamp of approval. On each sheet of every set of drawings there shall be clearly printed a conspicuous title in which shall appear the name of the county, the name of the city, village or town, and the name of the stream in which the dam is located, and the name of the owner thereof. The scale of the drawings shall be stated under the title. When the designs have been approved by the Commission, one set will be returned to the owner, with such approval endorsed thereon. Copies in duplicate of the specifications under which the dam is to be constructed shall accompany the plans.

Inspection.—The name of the inspector and a statement of his experience in such work must be sent to the Commission. There must also be sent a sample of at least one-half a cubic foot of sand and of cement, and twenty cubic inches of the stone for concrete or masonry to be used in the structure, and of the natural materials in the foundation bed. The foundation bed, after it has been cleared and prepared, must be inspected subject to approval by the Inspector of the Commission. The inspection of materials takes about ten days in the laboratory. On request tags will be sent for labeling the materials.

STATE OF NEW YORK

DEPARTMENT OF

State Engineer and Surveyor

ALBANY

Received July 22d 1922 Dam No. 537 L Hudson Watershed

Disposition Plans approved July 24th 1922 Serial No. 463

Site inspected

Foundation inspected

Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed plans, marked Dam, Beacon Reservoir, City of Beacon, Dutchess County N.Y.

herewith submitted for the {~~construction~~ / reconstruction} of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam.

1. The dam will be on a branch of Fishkill Creek in the town of Fishkill, County of Dutchess and is two (2) miles from City of Beacon (So. Beacon Stn.)
(Give exact distance and direction from a well known bridge, dam, village, main cross-roads or mouth of a stream)

2. The name and address of the owner is City of Beacon N.Y.

3. The dam will be used for Water Supply

4. Will any part of the dam be built upon or its pond flood any State lands? No

5. The watershed at the proposed dam draining into the pond to be formed thereby is less than 1/2 Sq. Miles square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 150 acres and will impound cubic feet of water.

7. The lowest part of the natural shore of the pond is very high feet vertically above the spillcrest, and everywhere else the shore will be at least feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was cubic feet per second on (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam, Considerable

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) ledge.

11. The material of the right bank, in the direction with the current, is Rock Ledge; at the spillcrest elevation this material has a top slope of ..... inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of ..... feet, and the top surface extends for a vertical height of ..... feet above the spillcrest.

12. The material of the left bank is Rock Ledge; has a top slope of ..... inches to a foot horizontal, a thickness of ..... feet, and a height of ..... feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Hard & impervious

14. If the bed is in layers, are the layers horizontal or inclined? no If inclined what is the direction of the slope relative to the center line of the dam and the inches vertical to a foot horizontal?

15. What is the thickness of the layers?

16. Are there any porous seams or fissures?

17. WASTES. The spillway of the above proposed dam will be ..... feet long in the clear; the waters will be held at the right end by a ....., the top of which will be ..... feet above the spillcrest, and have a top width of ..... feet; and at the left end by a ..... the top of which will be ..... feet above the spillcrest, and have a top width of ..... feet.

18. There will be also for flood discharge a pipe 22 inches in diameter and the bottom will be ..... feet below the spillcrest, a sluice or gate ..... feet wide in the clear by ..... feet high, and the bottom will be ..... feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of ....., ... feet long, ... feet wide and ..... feet thick. The downstream side of the apron will have a thickness of ..... feet for a width of ..... feet.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings of the proposed structure. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape, the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the plans any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back sheet of this application make a sketch to scale for each different cross-section at the highest point; showing the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; and the abutments by their top width and top lengths from the upstream face of the spillcrest and give the elevation of the top in reference to the spillcrest.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at both ends of the spill; and of the spillcrest for the above proposed dam.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand one-half a cubic foot is desired; for cement, three pints; and for the natural bed, twenty cubic inches.

24. INSPECTION. State how inspection is to be provided for during construction.

Drains between new and old concrete, shown on plan. to have three (3) outlets in each panel between buttresses.

Geo. W. Kriegor Jr.

The above information is correct to the best of my knowledge and belief.

P.O. Box 116 Poughkeepsie
(Address of signer)

July 22, 1922
(Date)

George U. Kriegel Jr.
Consulting Engineer.
(A person signing for Applicant should indicate his title or authority).

CITY OF BEACON
NEW YORK

March 7, 1974

Mr. George A. VanEtten
Dam Safety Program
N. Y. State Dept. of Environmental Conservation
50 Wolf Road--Room 601
Albany, New York 12201

Re: Registered Dam No. 537
Upper Water Supply Reservoir
City of Beacon

Dear Mr. Van Etten:

Referring to your letter of March 1, 1974 regarding resurfacing of Dam 537. This dam has been completely rehabilitated.

All loose concrete has been removed and where evidence of cracking was indicated all concrete was notched and monolithically replaced. 10 x 10 wire mesh was placed over all surfaces and 1/2" rebars were placed on upstream face. Complete surface was then covered with gunite to a minimum depth of 2" to as much as 6" in some areas. The entire structure was grouted internally.

'74 MAR 12 AM

I consider the Dam in A-1 condition at this time.

Very truly yours,

Harry C. Ingerson

Harry C. Ingerson
City Engineer

cc: Com. Flynn

Division of Resource Management Services
Bureau of Water Regulation

January 17, 1973

Honorable Robert L. Cahill
City Hall
Beacon, New York 12508

Dear Mayor Cahill:

Registered Dam No. 537
Water Supply Reservoir
City of Beacon

Last summer, our dam inspection team, as part of the Department's program on Dam Safety, made a visual survey of the above-subject dam. The dam was not classified as unsafe, but the inspectors did note that maintenance was needed.

The report indicates that concrete surfaces at or near the overflow section were spald and leakage was observed near the spillway about 18 inches below the crest.

If the impoundment and height of the dam were less, the report would have been routine.

However, the hazard is high enough to mention that a program of maintenance and repair should be followed by the City.

If you have any questions, please contact this office at (518)457-7418.

Very truly yours,

Stanford Zeccolo
Senior Hydraulic Engineer

SZ:ls

DAM DAM INSPECTION REPORT

ST	CTY	YR AP.	DAM NO.	INS. DATE	USE	TYPE
21	14	22	00537	04 27 72	C	03

AS BUILT INFORMATION

1	Location of Sp'way and outlet	1	Elevations
1	Size of Sp'way and Outlet	1	Geometry of Non-overflow section

GENERAL CONDITION OF NON-OVERFLOW SECTION

1	Settlement	2	Cracks	1	Deflections
2	Joints	2	Surface of Concrete	2	Leakage
1	Undermining	1	Settlement of Embankment	1	Crest of Dam
1	Downstream Slope	1	Upstream Slope	1	Toe of Slope

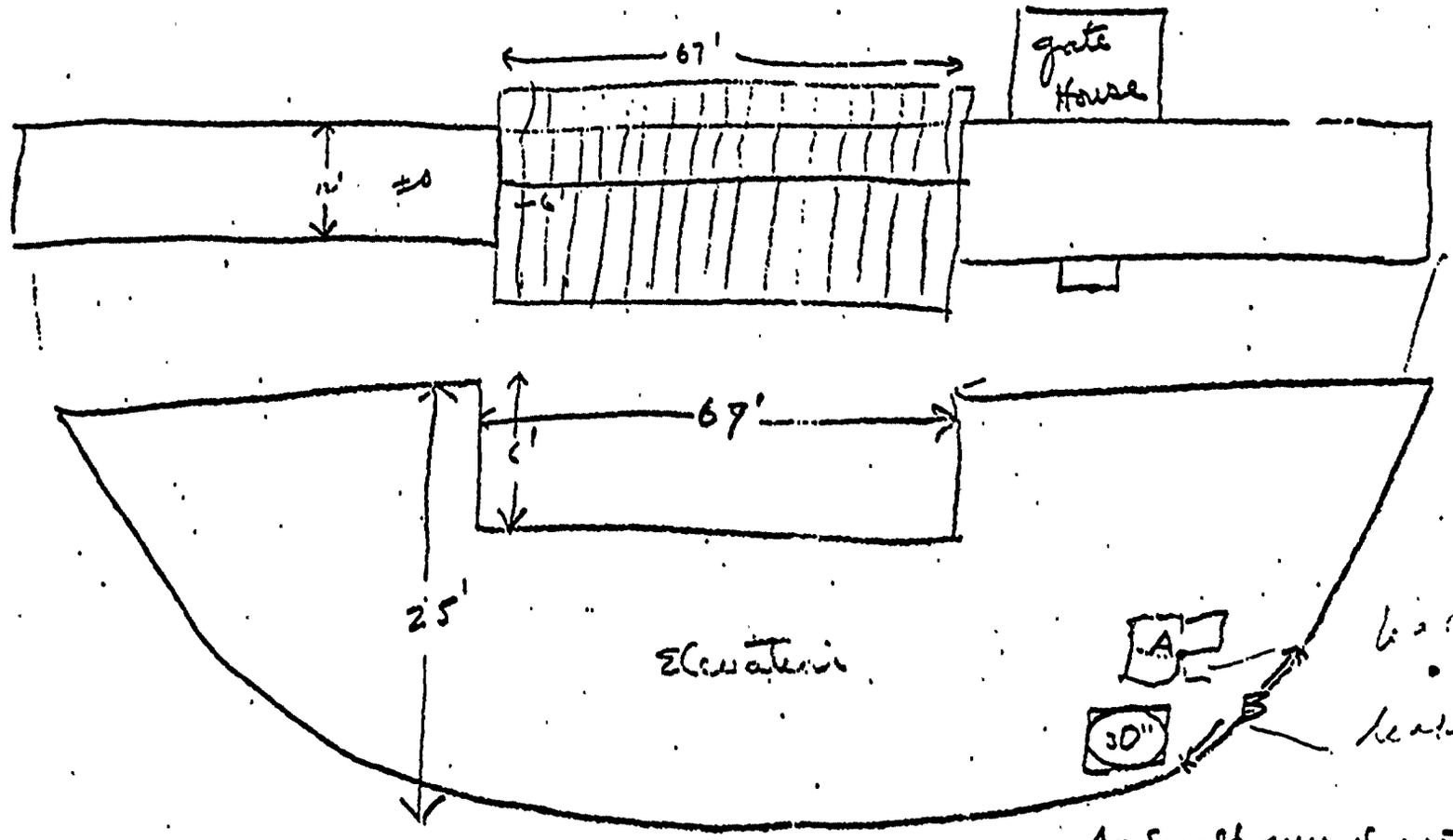
GENERAL COND. OF SP'WAY AND OUTLET WORKS

1	Auxiliary Spillway	1	Service or Concrete Sp'way	1	Stilling Basin
1	Joints	2	Surface of Concrete	1	Spillway Toe
2	Mechanical Equipment	1	Plunge Pool	2	Drain

2	Maintenance	6	Hazard Class
3	Evaluation	2	Inspector

COMMENTS:

Surface of concrete is spald
Some leakage near spillway about 18" below crest


67'
gate House
12' ±0
+6'
67'
1'
25'
Excavation
A
30"
B
A - Small area of water-a
B - along this section there is
a little Excavation